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EXPLORATION IN SAVINGS BEHAVIOUR

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Summary

This paper essays a reasonably comprehensive econometric analysis of the results of the 1953 sample Savings Survey of residents of the United Kingdom. Part I consists of a preliminary survey of the problem and methods of analysis and of a search for the key variables influencing individual saving patterns.

In Part II two new theories of saving propounded by Modigliani and Brumberg and by Friedman are submitted to more specific testing. The Modigliani-Brumberg theory is extended to cover variations in family size, and the implications of the Friedman hypothesis as to the role of assets as a reserve for emergencies are elucidated. A number of facets of these theories are submitted to test and their implications for the analysis of comprehensive and representative equations adumbrated.

PART I

A RECONNAISSANCE

The usefulness of economic theory depends upon its ability to interpret observed economic behaviour—to explain the facts. Failure at this crucial stage necessitates rejection or revision of the theory. Support, on the other hand, breeds confidence, which grows in proportion to the spread and diversity of evidence which the theory or its derivative implications are successful in explaining.

Empirical analysis of savings behaviour has, in this country, lagged behind the formulation of theory. The Savings Surveys conducted by the Oxford University Institute of Statistics in recent years make it possible to adjust the balance. Within the limits imposed by a one-period cross-section survey, this paper is concerned with the testing of certain hypotheses on savings behaviour and the quantifying of some of these theoretical relationships.

Many of the dynamic savings theories, for example those of Hicks, Klein and Mosak,¹ bring into relief the major influencing variables but are silent as to the form of the relationship. In general, these theories stem from the concept of an individual engaged in utility maximisation over time and show that, under conditions of certainty, current savings may be expressed in terms of current and expected incomes, prices, interest rates and liquid asset (sometimes total asset) holdings at the beginning of the current period. In so far as capital accretions are foreseen, they are allowed for in the appropriate period. Few, if any, qualitative properties materially assist in the specification of the form of the function and for these theories this becomes a matter for empirical determination.

This bewildering array of explanatory variables is further augmented when we are confronted in empirical testing with information from sets of individuals who differ in a number of other respects, such as age, sex, or occupation, to mention but a few. Moreover the individual planning unit is rarely an individual acting alone but is a group such as the family or household. This may give rise to further conceptual problems which we choose to ignore, but in any case it adds to our classification of variables such influences as the number, sex and age of the members that together constitute the planning unit. On factors such as these, traditional theory has been much less specific, and consequently the empiricist receives little guidance.

Empirical examination is simplified in so far as certain variables can be treated as though they were constant. For example, in utilising a one-period cross-section sample for this purpose we typically regard prices and interest rates as invariant. The greater the sub-classification possible, the easier our task becomes.

In quantitative economics, if not also in theory, our aim is not to include

¹ J. R. Hicks, *Value and Capital*, Oxford, 1946, Chap. XVIII. L. R. Klein, *Economic Fluctuations in the U.S.A.*, New York, 1950, p. 40–50. J. Mosak, *General Equilibrium Theory in International Trade*, Indiana, 1944, Chap. VI.

every conceivable variable but to endeavour to account for the observed variability of savings patterns for the units in question with a minimum number of variables.¹ On the other hand an exact explanation should not be expected. Precise testing is impossible. The assumed theoretical relationship must be rendered stochastic prior to empirical test, and judgment upon its performance made in probabilistic terms. Residual unspecified influences bearing on savings patterns are generally introduced by the association of a portmanteau disturbance term assumed to possess certain reasonable statistical properties.

There is more than one method of procedure. We have already alluded to the advantages of extensive sub-classification. A cursory examination of the array of variables is enough to show that if sufficient observations are to be provided within a cell, the members of which possess a number of common characteristics, the sample size for a multi-cell design will have to be very large indeed, so large as to be impractical with present resources. To some extent these limitations may be relaxed if it proves possible to combine information from samples in different years.

An alternative procedure would be to take the whole array of information collected in a sample survey and employ multivariate methods, principally multiple regression analysis, to gain further insight into the basic phenomena. Variability in data is appreciably greater in this case and it is unlikely that the contribution to the explanation of the variance of savings by any single variable will be large, though the consideration of the sample as a whole may permit the influence of more than one variable to be more clearly discerned.

We feel that this method is inferior to the former, though this view is tempered insofar as some of the benefits of sub-classification can be achieved with favourable effects on efficiency.

In the employment of data relating to savings and incomes, etc. of different individuals to test theories concerning the response of an individual, certain assumptions are involved which we shall endeavour to elucidate.

Suppose we select information on a set of planning units of similar age, family size and occupation classes from a sample of individuals interviewed within the same period of time. We wish to use this information to shed light upon the reactions on the savings pattern of an individual consequent upon a change in his income. We make the assumption that the reaction of an individual to say, an income increment of £100 from £500 to £600 will bring forth a similar response on his savings pattern to that recorded by the difference, on average, between the savings of those enjoying £500 a year income and those individuals in receipt of £600 per year. We assume that the individual responds to this income increase in precisely the same way as if he had passed from a lower income group to one that is higher by the amount of the increase.

¹ J. Tobin, *Savings in the Modern Economy*, Ed. W. Heller, F. Boddy and C. Nelson, Minnesota, 1953, p. 221.

To the extent that savings are in fact determined by prospective incomes we must be more specific. If we wish to test a certain hypothesis concerning the variation in savings by an individual consequent upon an income increment of £100 thought likely to be sustained indefinitely on top of his previous steady income of £500 per year we assume that the response will be the same as the recorded difference between the average savings of individuals who have hitherto received and expect to go on receiving £500 per year and those who have up to the year before interview belonged to this group but have now received an extra £100 which they expect to be continued in the future.

Clearly an essentially similar basis of reasoning can be extended to instances where more variables or time periods must be allowed. Further implications of this procedure will be delineated in the next section.

Practical problems in using survey information

The organisation and execution of the 1953 Savings Survey of residents in the United Kingdom has been described by others, and we relegate matters other than those of immediate concern to the appendix.

Certain problems of statistical estimation which arise out of the sampling scheme employed and difficulties associated with the cross-section analysis *per se* must now be discussed.

For a fruitful enquiry into the patterns of resource allocation of those members of the community who are its principal savers it was deemed advisable to over-sample those in higher-income groups. Income itself would, of course, be the best indicator for pre-sample stratification, but since no information on income could be obtained *before* the questions were asked in the survey, rateable value of property was employed as a proxy. Those residing in property valued at £30 or more were over-sampled in the ratio of 8 to 1.¹ If we then employ the observations obtained from the sample returns in our study without correction, we shall obtain estimates that are weighted in accordance with our sampling procedure and do not conform to the proportions in different rateable-value, and indirectly, income groups in the population as a whole. For many purposes there may be no advantage in having estimates that are representative in this sense. But if representativeness is desired it is necessary to counterweight the observations obtained from the two strata by multiplying them by the inverse of their sampling rates after correction for degrees of response, since these may differ between the two strata.² We have adhered to this procedure throughout.

In discussing representativeness, we are prompted to emphasise that the surveys did not attempt to cover all members of the private sector of the economy of the United Kingdom. They excluded residents in Northern Ireland and all who lived in hotels, boarding houses and other institutions, including members of the Armed Forces, together with those residing abroad,

¹ In London the dividing line was set at £40 instead of £30.

² In 1953 the response rates in the upper and lower strata were 47.2 per cent and 68.9 per cent respectively, giving a weighted average for the two combined of 66.1 per cent.

whether temporarily or permanently. Business firms and non-profit-making institutions were automatically excluded.¹

Moreover, as H. F. Lydall² has emphasised, the survey estimates of incomes and assets when magnified to national dimensions are appreciably lower than alternative authoritative estimates, the main direct operating factor being the non-co-operation of many of those in the higher wealth classes and a tendency by those in these groups who did respond towards understatement of their holdings.

Available evidence suggests that savings, incomes and asset-holdings tend to be understated by respondents. For mean-level predictions this is a serious shortcoming in the surveys. It is of less immediate concern in cross-section analysis for the derivation of average or marginal coefficients to the extent that all respondents tend to understate the values of each variable to approximately the same degree. But this assumption is tenuous. Working with the survey material one gains an impression that savings items tend to be understated but consumption expenditures do not. If this is so, in a total such as 'savings plus durables' systematic understatement will occur in the first component alone. In this event direct comparisons of, for example, savings/income and savings plus durables/income ratios are vitiated by the presence of a proportionality factor which cannot be independently assessed. Similar difficulties will emerge in the interpretation and comparison of marginal coefficients insofar as the assumption made above is violated. Non-systematic errors must also be expected. Those that occur in the dependent variable can, as a general rule, be allowed for in the methods of estimation we employ, but this is not the case when the errors are located in the explanatory variables. Fortunately, some of these variables—those pertaining to the demographic characteristics of the unit—are more reliably reported.

Another practical difficulty in the collection of survey data concerns the rules to be adopted with respondent forms where information is not complete. The following procedure was adopted. Where income was not returned all information from the interviewed unit was rejected. Where there was deficient information on current liquid asset holdings from any unit, that unit was assigned values equal to the average holdings of the individuals in the same age and gross income group in the previous year's survey.³ All cases where there were gaps in the coverage of savings components were excluded.

In the preparation of material for multivariate analysis we have to decide what to do with information obtained from households whose savings patterns appear *prima facie* to differ in some respects from those of members of a group with whom they have many characteristics in common. These 'extreme' observations may, in fact, arise because the households correspond to a different behaviour pattern from those with whom we have associated

¹ It is claimed by T. P. Hill that the proportion of self-employed people was seriously underestimated in 1953, *BULLETIN*, May 1955, p. 168, 169.

² H. F. Lydall. *British Incomes and Savings*, Oxford, 1955. p. 236.

³ No such procedure was adopted in estimating liquid asset holdings one year ago. See Appendix D

them.¹ Alternatively they may appear 'extreme' solely because of the smallness of our sample and our consequent inability to depict the scene in the outfield of the scatter diagrams. Our natural inclination is to retain as relevant all available information but, insofar as our analysis is concerned with the detection of regularities in behaviour the retention of an 'extreme' item may distort the picture as far as any of the groups we have selected is concerned. A more effective resolution of our dilemma may be to resort to purely graphical techniques with their greater dependence on judgment rather than to mechanical estimation methods, though this procedure might still conceal the presence of more than one underlying behaviour pattern.

But this discussion presupposes that such information is spread out on a table in front of us where the sum total of information on any single household can be viewed in relation to others. With over 2,000 returns this is impracticable. Extreme observations must be adjudged on values for each variable individually—a much less satisfactory solution which can easily lead to excessive rejection. In practice, we have elected to exclude all information from households for whom the observation of any variable falls at either tail of the cross-section frequency distribution of that variable, provided there has occurred a marked gap in the continuity of the distribution. A summary of the rejected cases is presented in Appendix B.

Methods of estimation

Our method of analysis is to take certain functional relationships suggested by theory, and submit them to statistical test. In the first instance we shall examine the statistical characteristics of relationships between the variables and gain an impression of the importance of certain explanatory variables. Hypothesis testing at this stage takes the form of rejection of the null hypothesis that the variables included in the relationship are independent. At a later stage we shall examine certain theories in which more stringent economic restrictions are imposed on the functions thereby widening the possibilities of hypothesis rejection. Throughout we employ methods of multivariate analysis that enable the quantitative influence of individual variables to be discerned. Ease of analysis and computational simplicity lead us to adopt the well-tried procedure of least squares. This method yields, under certain conditions,² estimates that are described as best linear and unbiased. If we conceive of the observations which we have at our disposal as constituting a sample from an underlying population postulated to accord with a relationship linear in parameters, we may interpret unbiasedness to imply that, given a number of such samples drawn from the population, the mean value of the parameter estimates calculated from such samples by least squares tends to accord with the underlying coefficient assumed for the population. Moreover, 'best' in this context means that the least-squares method yields estimates of coefficients, which upon repeated sampling, have less dispersion about

¹ A sufficiently comprehensive array of explanatory variables should help to overcome this.

² F. N. David, *Probability Theory for Statistical Methods*, Cambridge 1949, Chapter XIII.

their mean value than those obtained by any other procedure. Conditions that must be satisfied if both these properties are to apply include :

(1) the explanatory variables must be distributed independently of the disturbance term. Since the latter comprises in the main non-specifiable influences impinging upon the dependent variable this condition boils down to the proviso that measured and non-measured variables be distributed independently of one another.

(2) the variance of the disturbance term should not vary across arrays of any independent or dependent variable. When this condition is fulfilled the distribution of the disturbance is described as homoscedastic; when not, heteroscedastic. The point involved may be illustrated by reference to a scatter diagram. With y as dependent variable we postulate an underlying relationship $y = \alpha + \beta x$.

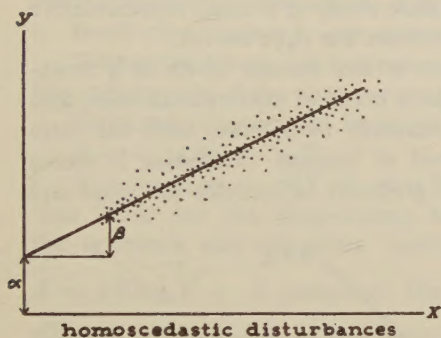


fig.1.1a

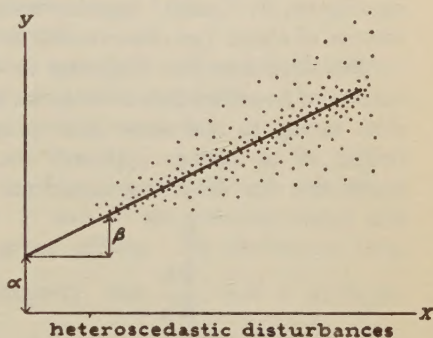


fig.1.1b

The observed points will be spread about this line. We assume that the unexplained portion of y is accounted for by a disturbance term u which has the properties that its mean is zero and its variance is finite and constant.

If there is a tendency for the observed points to deviate from the underlying line of relationship to greater or less degree as x increases (e.g. Fig. 1.1 b) we say that the distribution of the disturbance appears to be heteroscedastic.

Thus assumption (2) concerning the disturbances implies that the spread of points about the hypothetical line of relationship remains the same for all values of x .

(3) There must not be an exact equation linking any of the independent variables. The greater the interdependence between these explanatory variables the more swollen become the standard errors of the coefficients. This phenomenon is described technically as 'multicollinearity'.

The linearity requirement of least squares theory is less restrictive than at first sight appears for it refers to parameters not variables.

Since the form of the savings function is not theoretically specified, the

desire for simplicity leads to the initial selection of forms that are linear in parameters. There remains the problem of specifying the nature of the disturbance term. It seems reasonable to assume that it is distributed independently of the independent variables, but empirical evidence from earlier savings analyses, such as those of Mendershausen¹ and the Michigan enquiry,² suggests that the distribution of the disturbance term is markedly heteroscedastic. Economically it is very plausible that the variability of savings unexplained by certain key variables should be itself greater as, for example, incomes are greater, and the dispersion of saving in income arrays points in this direction. The nature of such variability will be examined more fully later.

The form of the relationship

In our preliminary search for suitable functional expressions we made use of the tabulated results by two-way classification for 1952 published with description by Lydall,³ together with a close study of a small representative sample of about 130 observations drawn from the 1952 survey.

We should expect dissaving to occur at low income levels in a cross-section of households, a break-even point to occur at moderate incomes, and then saving to rise more than proportionately to income, with the ratio tailing off as savings approach the level of income. Moreover it seems reasonable that dissaving should tail off gradually as incomes fall more and

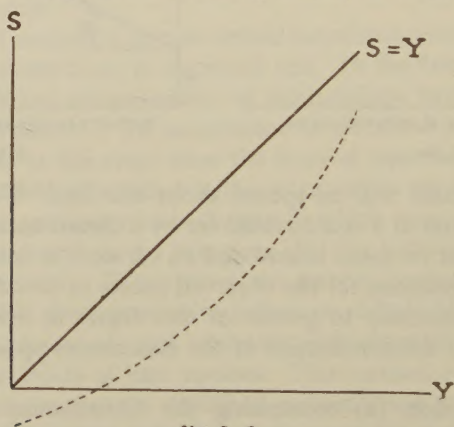


fig. 1. 2

more below break-even levels, since there must be some limit to the size of realisable assets and potential borrowing ability of individuals. With insufficient observations towards the extremes to justify their retention when we use mechanical estimation procedures, the choice of function will lie between those that give a good fit to the main body of the data.

¹ H. Mendershausen, 'The Relationship Between Incomes and Savings of American Metropolitan Families', *American Economic Review*, Vol. 29 (1939), pp. 521-537.

² L. R. Klein and J. N. Morgan, 'Results of Alternative Treatments of Sample Survey Data', *Journal of the American Statistical Association*, Vol. 46 (1951), pp. 442-460.

³ H. F. Lydall, *op. cit.*

Denoting savings by S and income by Y , the straightforward linear equation $S = aY + b$ permits no variation in $\frac{dS}{dY}$, the marginal propensity to save, but may prove adequate over the observed range. Break-even income (E) is $-\frac{b}{a}$. Since we assume $a > 0$, b must be less than zero if E is to be positive. The equation may be rewritten $\frac{S}{Y} = a \left\{ 1 - \frac{E}{Y} \right\}$. The saving-income ratio rises with income, tending to a for Y tending to infinity.

Calculations from the mean savings in net income groups from the 1952 survey yield the following estimates:

$$S = -29.54 + .09Y \quad r^2 = .45 \quad (1.1)$$

These are estimates weighted not only as between strata but also through the employment of the inverse of the standard deviations of savings to offset the worst effects of heteroscedastic disturbances.

Break-even income is approximately £328.

Alternative functional expressions were examined with the 130 observation sub-sample of the 1952 survey (excluding self-employed).

Estimates (uncorrected for heteroscedasticity) include

$$S = -51.85 + .14Y \quad r^2 = .05 \quad (1.2)$$

$$S = -26.97 + .08Y + .0003Y^2 \quad r^2 = .05 \quad (1.3)$$

The latter has the disadvantage that Y and Y^2 are intercorrelated and the estimates may therefore exhibit gross effects. An alternative form

$S = aY \log_e Y + b$ possesses the property that $\frac{dS}{dY} = a + a \log_e Y$.

$\frac{dS}{dY}$ increases with income and equals zero for $Y = .37$, a limit being thereby set to the rate of dissaving.

In fact, in the small sample this form combined additively with liquid assets, L , gave a good fit

$$S = -99.19 + .1391Y \log_{10} Y - .1312L \quad R^2 = .47^* \quad (1.4)$$

There are serious drawbacks to a variable by variable examination, as interaction effects between explanatory variables are concealed unless steps are taken to hold these variables constant.

For example, the relation between savings and age is such that savings tend to rise regularly with age up to the 45-54 age-group and then decline, with net dissaving in the over-65 age bracket. This suggests a non-linear relation between these variables. Likewise the saving-income ratio tends to change with age in this manner. But savings, incomes, assets, and numbers in the family display different age patterns and failure to hold these constant in any two-variable examinations may be very misleading. At best we can argue that the savings-age relation may be parabolic, a numerical relationship

*All the above relationships yield correlation coefficients which indicate an other than chance connection between the variables on the standard tests of significance. The usefulness of these tests is limited insofar as they are strictly applicable only to data drawn from a 'normal' population.

such as $S = -aA^2 + 88aA - 1260a$, $a > 0$, giving a maximum S at $A = 44$ (age) and negative values below 18 and above 70, appearing superficially to accord well with the data.

Preliminary screening of this type is at best suggestive and we turn to the closer examination of results from the 1953 sample, using some of the relationships that appeared promising in the trial runs. In this operation all entrepreneurial groups were put to one side. We not only obtain estimates from an overall non-entrepreneurial relationship but examine the estimates and the variance of the residuals by net income groups, since Klein's and Morgan's work at Michigan¹ indicated very strongly that the estimates of the standard deviation of the residuals varied directly with income.

As the processing was carried out on Hollerith equipment it was possible to experiment with a large number of functional forms linear in the parameters. The first point worthy of comment is that there is a sharp deterioration in the value of the multiple correlation coefficient for the same underlying relationship as we move from the 130 observation case to the large sample. This serves to emphasize that one should be particularly chary of multiple regression results giving a high quality fit to data drawn from small samples, or sets of means of observation for that matter. This deterioration one suspects, is more likely to be the case when, as in this study, the range of variability in the dependent variable is very large and the explanation contributed by any single variable is relatively small.

Other special factors may help to account for the disparity. For example, the two samples relate to different years, 'extreme' observations in a small sample may be different from those in the large, but even so appreciable differences in quality of fit cannot be completely accounted for in this way and caution must be exercised in drawing conclusions from such small samples.

Empirical Results

The main relationship fitted is

$$S = a + bY + cL + dLY + eA + fJ + u \quad (1.5)$$

where²

S = savings

Y = net income

L = liquid asset holdings at beginning of year

A = age in years

J = number in income unit

u = disturbance.

We have already provided some justification for the inclusion of all these variables. The suggested employment of non-linear functions in A is not easy to effect, since the simultaneous inclusion of A and A^2 , and perhaps this applies to J and J^2 also, is likely to introduce a very high degree of multicollinearity among the independent variables. The inclusion of a term in

¹ *Op. cit.*

² See Appendix 1) for definitions.

LY is less easily justified *a priori*. It implies that the cross-section marginal propensity to save with respect to income depends on liquid asset holdings. This influence has been found of some importance in Klein's and Morgan's study,¹ so that there is a case for seeing if it shows up in a comparable manner in the explanation of the United Kingdom's savings patterns.

Empirical results using weighted estimates and excluding self-employed persons are as follows :

$$(1) S = -8.21 + .05Y - .08L + .00007LY - .0063A - 2.944J \quad (1.6)$$

(12.66) (.01) (.02) (.00001) (.1451) (1.954)

$$R^2 = .06341$$

$$(2) S = 17.57 - .07Y + .00012Y^2 + .00001LY - .05L - .1740A - .4784J$$

(10.07) (.02) (.00005) (.00001) (0.01) (.1458) (2.0021)

$$R^2 = .0848 \quad (1.7)$$

$$(3) S = -4.14 + .01802Y \log_{10} Y - .10L + .00007LY - .0566A - 3.0504J$$

(9.03) (.00427) (.03) (.00001) (.1522) (1.9126)

$$+ .00045LA$$

(.00041)

$$R^2 = .0643 \quad (1.8)$$

The means of the individual variables are :

$\bar{S}$	$\bar{Y}$	$\bar{L}$	$\bar{LY}$	$\bar{A}$	$\bar{J}$
-3.10	396.08	165.15	85630	46.4	2.3

The mean cross-section marginal propensities to save with respect to income and liquid assets respectively are :

$\frac{\partial \bar{S}}{\partial \bar{Y}}$	(1) .06 (.085)	$\frac{\partial \bar{S}}{\partial \bar{L}}$	(1) -.055 (-.024)
	(2) .016 (.125)		(2) -.047 (-.042)
$\frac{\partial \bar{S}}{\partial \bar{Y}}$	(3) .058 (.105)		(3) -.057 (-.026)

The values for net incomes of £800 and assets of £500 at age 46 as shown in brackets, merely indicate how the marginal propensities move in the upper reaches of the income and asset categories.

Liquid assets, *ceteris paribus*, exert a negative influence upon savings and income a positive influence. The cross-section *average* propensity to save—mean savings divided by mean net income—is—.008. Savings are negatively related to age and family size, though the influence of the former is highly uncertain, the standard error in two of the three equations exceeding by a considerable margin the point estimate. In the second equation, on the other hand, the coefficient of age is significant² and that of family size uncertain. Moreover a significant value for the constant is obtained in this equation only. On goodness of fit criteria, the second equation in which income enters parabolically gives the best fit. The juxtaposition of Y and Y^2 has not led to multicollinearity, but tests with A and A^2 and J and J^2 revealed that because of the small variation in their magnitudes, estimates were distorted by high multicollinearity.

¹ *Op. cit.*

² Throughout this section we use the word 'significant' in the broad sense to indicate that the standard error does not exceed the parameter estimate.

The data were next subdivided into nine net income classes and the same relation as in (1) above fitted to each group of data. The means of the variables within groups are :

TABLE 1.1

Group	Net Income Class (£)	$\bar{Y}$	$\bar{S}$	$\bar{L}$	$\bar{LY}$	$\bar{A}$	$\bar{J}$
I	0-99	79	- 13.4	162	11300	66	1
II	100-199	143	- 9.6	123	18710	55	1.3
III	200-299	249	- 4.4	101	26040	44	1.6
IV	300-399	348	- .02	114	41080	43	2.5
V	400-499	441	- 8.1	145	64460	42	3.2
VI	500-599	539	+ 9.2	180	99700	41	3.4
VII	600-799	672	- 17.6	304	216610	41	3.3
VIII	800-999	872	+ 29.5	442	394350	42	3.3
IX	1,000 and over	1365	+107.0	996	1472570	48	3.0

The resulting estimates of the coefficients are :

TABLE 1.2

Group	Constant	Y	L	LY	A	J	R ²
I	- 35.19	+ .85 (1.97)	-.06 (.21)	+.00004 (.00028)	-.1371 (.2242)	-27.18 (32.09)	.4482
II	+ 10.04	-.09 (.12)	-.07 (.05)	+.00032 (.00028)	-.0263 (.1386)	- 2.75 (4.81)	.0159
III	+ 21.25	-.04 (.08)	+.09 (.03)	-.00050 (.00013)	-.1850 (.1249)	- 2.14 (2.75)	.1067
IV	- .86	+.04 (.17)	+.11 (.18)	-.00048 (.00031)	-.1363 (3.0575)	+ .27 (3.34)	.0689
V	+ 5.72	+.02 (.44)	+.04 (.40)	-.00026 (.00092)	-.0888 (.3024)	- 2.31 (3.75)	.0964
VI	- 19.63	+.02 (.38)	+.13 (.58)	-.00019 (.00103)	+.1979 (.6222)	+ 1.16 (4.78)	.0109
VII	- 89.30	+.16 (.23)	-.11 (.25)	+.00007 (.00034)	-.2791 (1.0065)	- 1.52 (9.17)	.0877
VIII	-701.00	+.76 (.71)	+1.72 (.55)	-.00203 (.00063)	+1.209 (3.303)	+15.52 (26.69)	.1351
IX	+ 92.85	+.48 (.19)	+.11 (.23)	-.00006 (.00013)	-9.904 (6.533)	-61.85 (52.74)	.2443

Save for the two highest net income groups the standard errors of the income variable exceed the point estimates, which need occasion no surprise when we are endeavouring to hold income constant. Only in Groups VII to IX is the range of income within a class appreciable. Groups III and IX yield clearly significant age components and Group IX alone a significant family size component. Groups II, III and VIII provide significant L coefficients and these, together with Group IV, a significant LY coefficient. Mean marginal propensities to save with respect to liquid asset holdings, $\frac{\partial \bar{S}}{\partial \bar{L}}$, are negative save for groups VI and IX, which implies that $\frac{\partial \bar{S}}{\partial \bar{L}}$ is not significantly positive in any group. Standard errors of the constants are not computed, but, if the total estimates are any guide, they must be much in excess of the parameter estimates.

We have two motives in making this breakdown by net incomes. The first is to endeavour to establish whether people in different income groups

can or cannot be said to be conforming to different behaviour patterns. On this, because of the size of sampling errors, our results are essentially uninformative, save that income exerts a stronger stimulating effect on savings at the margin in group VIII than group IX. Our second objective is to derive the standard errors of residuals from these relations to see if they move at all systematically with the income variable. These estimates corrected for degrees of freedom are as follows.

TABLE 1.3

Group	σ_{rs}	$\bar{Y}$
I	31.51	79
II	49.10	143
III	34.32	249
IV	67.33	348
V	78.77	441
VI	88.71	539
VII	132.04	672
VIII	197.11	872
IX	345.64	1365

σ_{rs} = Standard deviation of regression residuals.

$\bar{Y}$ = Mean net income.

It is immediately evident that these are positively associated with means of income groups. The results obtained with these as dependent variable and the means of income, assets or income times assets as independent variables are :

$$\sigma_{rs} = .25\bar{Y} - 14.46 \quad r^2 = .96 \quad (1.9)$$

$$\sigma_{rs} = .34\bar{L} + 15.81 \quad r^2 = .96 \quad (1.10)$$

$$\sigma_{rs} = .00021\bar{L}\bar{Y} + 60.00 \quad r^2 = .92 \quad (1.11)$$

This high interrelationship adds support to Mendershausen's and Klein's findings that there is a sound empirical basis for assuming that the disturbance terms in the savings functions are of the form uY when S is dependent variable, while the interdependence with L suggests that the form of the disturbance term may be still more complex.¹ If this hypothesis be accepted then our earlier estimates, while bias-free, do not have minimum variance through the neglect of adjustments for heteroscedasticity.

On this fresh hypothesis, best unbiased estimates may be obtained if all terms in our earlier functional relationship are divided by Y and we use least squares methods as before. Total estimates on this basis are :

$$(1) \frac{S}{Y} = .028 - 2.20\frac{1}{Y} - .05\frac{L}{Y} + .00005L - .02\frac{A}{Y} - 2.03\frac{J}{Y} + u$$

$$\text{i.e. } S = -2.2 + .028Y - .05L + .00005LY - .02A - 2.03J + uY$$

$$(5.3) \quad (.015) \quad (.007) \quad (.00002) \quad (.07) \quad (2.04)$$

$$R^2 = .0672 \quad (1.12)$$

$$(2) \frac{S}{Y} = -.037 + 14.20\frac{1}{Y} + .00007Y - .05\frac{L}{Y} + .00005L - .17\frac{A}{Y} - 1.26\frac{J}{Y}$$

$$\text{i.e. } S = 14.20 - .037Y + .00007Y^2 - .05L + .00005LY - .17A - 1.26J + uY \quad R^2 = .0739 \quad (1.13)$$

¹ See in this respect, the chapters by J. N. Morgan in *Contributions of Survey Methods to Economics*, ed. by L. R. Klein, (Columbia Univ. Press, N.Y., 1954).

Comparison between these estimates and those in which no attempt is made to make the disturbance term homoscedastic does not disclose any significant differences between coefficients. The fit of the equations is still poor, the considerable variability in savings being ineffectually explained by the variables selected—at least in the form in which they are expressed.

Using the same net income breakdown as before the results are :

TABLE 1.4

Group	Constant	Y	L	LY	A	J	R ²
I	91.65 (27.87)	-1.26	-.64 (.05)	+.00684 (.00122)	-.168 (.107)	25.55 (17.10)	.7470
II	17.89 (20.22)	-.09	-.10 (.30)	+.00047 (.00027)	+.008 (.146)	-9.31 (7.67)	.0407
III	18.77 (59.28)	-.03	+.11 (.48)	-.00056 (.00019)	-.174 (.127)	-2.53 (2.79)	.0977
IV	34.00 (70.42)	-.05	-.07 (.18)	+.00002 (.00051)	-.161 (.291)	+.12 (3.49)	.0636
V	43.53 (90.29)	-.07	-.30 (.16)	+.00058 (.00037)	-.192 (.466)	-1.00 (4.09)	.0597
VI	-134.23 (151.47)	+.23	+.55 (.38)	-.00095 (.00068)	+.150 (.647)	+1.37 (5.38)	.0224
VII	-40.90 (160.98)	+.04	-.15 (.23)	+.00012 (.00032)	+.548 (1.092)	-1.23 (10.19)	.0791
VIII	-533.40 (547.60)	+.71	+1.68 (.59)	-.00195 (.00067)	-1.530 (3.714)	+6.26 (25.57)	.1512
IX	+110.17 (340.94)	+.52	+.15 (.18)	-.00007 (.00078)	-11.920 (4.304)	-57.15 (44.10)	.2467

There are some appreciable disparities between these and the earlier estimates, but when the reliability of the estimates is taken into account no significant differences emerge. The standard deviations of residuals by net income groups are :

TABLE 1.5

Group	$\sigma_{R_Y}^s$	Group	$\sigma_{R_Y}^s$
I	.196	VI	.168
II	.328	VII	.199
III	.138	VIII	.213
IV	.196	IX	.234
V	.185		

$\sigma_{R_Y}^s$ = Standard deviation of regression residuals.

Using these estimates as observations of the dependent variable we fitted the following equations :

$$\sigma_{R_Y}^s = .000003 \bar{Y} + .20471 \quad r^2 = .00053 \quad (I.14)$$

$$\sigma_{R_Y}^s = 3.191 \frac{1}{\bar{Y}} + .19465 \quad r^2 = .04735 \quad (I.15)$$

$$\sigma_{R_Y}^s = .00003 \bar{L} + .19765 \quad r^2 = .03884 \quad (I.16)$$

$$\sigma_{R_Y}^s = .1165 \frac{\bar{L}}{\bar{Y}} + .14095 \quad r^2 = .33372 \quad (I.17)$$

The replacement of savings by the saving-net income ratio as the dependent variable has made for much greater uniformity in the variances across net income arrays but the systematic interconnection between σ_{RS} and $\left(\frac{\bar{L}}{\bar{Y}}\right)$ indicates that a better approximation to the form of the error term might be $uf(Y, L)$, say $u(aY + bL)$.¹ Approximation methods would be needed to derive best estimates if the hypothesis concerning the disturbance term is couched in this form. We shall rest content with the adjustments made, since we shall shortly be questioning the suitability of this form of equation and method of approach.

In Tables 1.6—1.9 we list the empirical estimates by net income groups when income is excluded from the relationship and J, A, L alone make up the set of independent variables. In one case we have introduced a term in LA with favourable effects on the fit of the equations in some of the higher income groups.

TABLE 1.6. Equation $\frac{S}{Y} = a + bJ + cA + dL$
Non-Entrepreneurial Sample, 1953

Group	Constant	J	A	L	R ²
I	-.286	+.216 (.334)	-.0006 (.0024)	-.00018 (.00016)	.04
II	-.007	-.026 (.010)	-.0001 (.0009)	-.00012 (.00006)	.02
III	+.059	-.016 (.010)	-.0007 (.0005)	-.00012 (.00003)	.09
IV	+.038	+.000 (.101)	-.0004 (.0009)	-.00017 (.00004)	.06
V	+.030	-.004 (.009)	-.0003 (.0006)	-.00013 (.00003)	.06
VI	+.052	+.002 (.009)	+.0003 (.0012)	+.00004 (.00004)	.01
VII	+.082	-.000 (.014)	-.0001 (.0017)	-.00008 (.00003)	.07
VIII	+.032	+.009 (.031)	+.0015 (.0039)	-.00006 (.00004)	.03
IX	+.460	-.001 (.034)	-.0095 (.0046)	+.00009 (.00005)	.14

TABLE 1.7. Equation $S = a + bJ + cA + dL$
Non-Entrepreneurial Sample, 1953

Group	Constant	J	A	L	R ²
I	28.73	-22.94 (28.73)	-.12 (.21)	-.067 (.0140)	.40
II	-3.55	-3.30 (1.46)	-.00 (.14)	-.014 (.0085)	.01
III	11.48	-2.64 (2.59)	-.19 (.13)	-.032 (.0075)	.09
IV	12.36	+.23 (3.31)	-.15 (.30)	-.059 (.0147)	.07
V	13.98	-2.27 (3.66)	-.11 (.26)	-.071 (.0142)	.10
VI	-7.70	+1.08 (4.71)	+.21 (.64)	+.025 (.0195)	.01
VII	11.46	-1.24 (9.08)	-.17 (1.13)	-.058 (.0181)	.08
VIII	-39.89	+8.83 (27.88)	+1.52 (3.51)	-.056 (.0389)	.04
IX	566.77	-7.56 (51.48)	-11.32 (6.94)	+.108 (.0809)	.10

¹ See J. N. Morgan, *op. cit.*

TABLE 1.8
Equation $S = a + bJ + cA + dLA + eL$
Non-Entrepreneurial Sample, 1953

Group	Constant	J	A	LA	L	R ²
I	+29.66	-22.75	-.14	+.00021	-.081	.40
II	- 5.89	- 3.24	+ .04	-.00095	+.045	.02
III	+ 9.71	- 2.63	-.15	-.00051	-.002	.09
IV	+14.59	+ 0.19	-.19	+.00048	-.087	.07
V	+51.95	- 4.83	+.71	+.00336	-.270	.13
VI	- 9.43	+ 1.03	+.26	-.00019	+.032	.01
VII	+65.75	- 1.05	-1.43	+.00506	-.304	.10
VIII	+191.32	+ 8.98	-3.45	+.00825	-.498	.10
IX	+337.88	-12.87	-5.82	-.00513	+.353	.11

TABLE 1.9
Equation $S = a + bL$
Non-Entrepreneurial Sample, 1953

Group	Constant	L	R ²
I	- 2.44	-.068 (.014)	.39
II	- 7.93	-.014 (.008)	.01
III	- 0.80	-.036 (.007)	.07
IV	+ 6.88	-.060 (.014)	.07
V	+ 1.93	-.069 (.013)	.10
VI	+ 4.83	+.024 (.018)	.01
VII	+ 0.18	-.059 (.017)	.08
VIII	+52.1	-.051 (.028)	.03
IX	+52.4	+.055 (.078)	.02

Summary

We may now attempt to draw together our findings so far. One positive point first—the presence of marked heteroscedasticity has been disclosed, and this suggests that for minimum variance estimates some correction must be applied before or after estimation. The tendency for the standard deviations of residuals to be highly correlated with income suggests that the

use of $\frac{S}{\bar{Y}}$ in place of S as dependent variable may help to overcome this deficiency. It may be doubted whether the criterion that estimates should have minimum variance is of great importance in large samples. Where it would appear to be important is in enabling us to discriminate effectively between behaviour in different strata when the estimates obtained with S as dependent variable are subject to considerable sampling error.

A notable feature of our analysis has been the poor quality of fit in the relationships even at the higher income levels. For low income groups with small mean savings and little variability this is not unexpected, but in higher income groups with high income variability it is the more surprising to find

the weak connection between savings and age, numbers in family and liquid assets. People with the most variable incomes, the self-employed, have been excluded from our estimates, but no discrimination has been made between retired and working groups. We have so far adopted a purely portmanteau or jumble-sale approach to the data and this may account in considerable measure for the minor importance of certain variables. However, since the mean incomes of the retired and unoccupied are very low compared with the remainder and the variance not considerable—mean net income £167, variance £120—these people will be mainly in the first three income groups. But even so, age and family size have greatest influence in the highest income class. There are, of course, good arguments for inserting these terms in non-linear form, but the high standard errors obtained already ensure that complicated polynomial expressions will not advance matters. A breakdown by age groups may be the more rewarding. This leaves us with the liquid asset term which is significant for each income group in Table 1.7. Except in groups VI and IX the coefficient is negative, indicating a depressing influence on savings in the main. The top income group will be predominantly made up of members of the managerial group, and there is therefore some indication that they may be adhering to a different behaviour pattern in this respect from the other occupation groups. It is noteworthy that the average propensity to save with respect to liquid assets for constant current incomes is positive for income groups VI, VIII and IX, so that for groups VI and IX the average and marginal propensities point in the same direction. From our earlier total equations, which permit income to influence the marginal propensity to save with respect to liquid assets, we see that the marginal propensity would change sign from negative to positive within the vicinity of a net income of £1,000—1,100, that is, the top income group. We are not at the moment able to bring to light any reason why liquid assets affect saving positively in group VI.

Whereas there is considerable evidence that both current income and liquid asset holdings assist in explaining saving behaviour, there is little support for age and for the number in the income unit. However, our method of analysis by net income breakdown may inhibit the disclosure of the influence of these variables, as may our restricted choice of relationships. In all, it would probably be advisable to accept our work so far as nothing more than a preliminary probe into the nature of the savings relation in an endeavour to isolate important variables together with some assessment of their relative strengths. Results at later stages of our enquiry may then permit us to give more systematic content to the results adumbrated in this section.

PART II

TESTING OF ALTERNATIVE HYPOTHESES

Two fresh approaches to the analysis of saving behaviour have been proposed in the last year or two. The first is that of Professor F. Modigliani and the late Dr. R. E. Brumberg,¹ the second that of Professor M. Friedman.² In this section we examine some of their implications and, within the limits of our statistical material, submit them to test.

Both treatments spring directly from the generally accepted theory of utility maximisation over time but differ from their predecessors in that they impose more rigorous conditions on the functions, thereby rendering them more susceptible to empirical testing.

The Modigliani-Brumberg Hypothesis

In Modigliani's and Brumberg's theory the individual is conceived as continuously planning his consumption pattern for the remainder of his lifetime. Asset-holdings as such are assumed to yield no utility during the lifespan but enter into his preference pattern insofar as he desires to leave sufficient to pay off accrued debts on his decease and make provision for dependents. This approach has a close affinity to a treatment elaborated earlier by Mr. R. F. Harrod.³

Mosak⁴ has shown that when price-interest expectations are assumed constant the maximization of utility over time may be sub-divided into two parts :

- (1) the problem of choosing in each period the optimum bundle of commodities for any given total value of consumption;
- (2) the problem of determining what the total value of consumption in each period shall be.

Modigliani and Brumberg are primarily concerned with the second problem.

The individual is assumed to maximise his utility—which is taken to be a function of his present and all future consumptions and his assets bequeathed—subject to the constraint that initial assets, plus expected incomes over the life-span discounted to the present and aggregated, equal expected consumption similarly discounted and aggregated, plus the discounted value of assets bequeathed.

Certain simplifying assumptions are introduced.

(I) Prices remain constant over the planning period.

(II) Interest rates remain constant over the planning period. The rate at which an individual discounts the future is assumed equal to the market rate of interest.

¹ F. Modigliani and R. E. Brumberg : ' Utility Analysis and The Consumption Function: An Interpretation of Cross-section Data ', *Post-Keynesian Economics* (Ed. K. Kurihara) Rutgers Univ. Press, New Brunswick, 1954, pp. 388 ff.

² M. Friedman, *A Theory of the Consumption Function* (Mimeographed) National Bureau of Economic Research, 1955.

³ R. F. Harrod, *Towards a Dynamic Economics*, London, 1949, pp. 35 ff.

⁴ J. Mosak, *General Equilibrium Theory in International Trade*, Principia Press, Bloomington, 1944, Chap. VI.

(III) An individual neither inherits assets during the life-span nor plans to bequeath any at the end of the life-span.

(IV) The proportion of an individual's total resources that he plans to devote to consumption in any year of his life is determined only by his tastes and not by the size of his resources.

With these assumptions we can deduce the consumption in each successive year which will maximise his utility.

$$C_{\tau}^t = \gamma_{\tau}^t V_t \quad (\tau = t, t+1, \dots, L) \quad (2.1)$$

Planning is assumed to take place at time t and cover the remainder of the lifespan $L - t + 1$. γ_{τ}^t is a constant depending upon the utility function and the rate of interest but not on V_t , the size of expected total (discounted) resources as seen from the planning age t .

To facilitate exposition two further assumptions are made:

(V) Interest rates over the planning period are zero.

(VI) An individual plans to consume the same proportion of his expected total resources each year throughout life.

These lead directly to the individual's behaviour relationship—

$$C_{\tau}^t = \frac{1}{L_t} V_t \quad (2.2)$$

where $L_t = L - t + 1$ is the remaining life-span at time t . V_t may be rewritten as the sum of current income (Y_t), assets held at the beginning of the current period (a_t) and mean expected incomes (Y_t^e). It then follows that the current period saving relationship may be written—

$$S_t^e = \frac{L_t - 1}{L_t} Y_t - \frac{N-t}{L_t} Y_t^e - \frac{1}{L_t} a_t \quad (2.3)$$

This is the fundamental equation of the Modigliani hypothesis.¹ N is the total earning span and $\sum_{t=1}^N Y_t = (N-t) Y_t^e$.

We may illustrate the essentials of the Modigliani theory with a simple diagram based on assumptions I—VI with the additional assumption, made for expository convenience, that income is expected to remain uniform throughout the earning span. We map time on the horizontal axis, saving, consumption and income on the vertical axis. Income continues at a constant level until retirement, when it falls to zero, whereas consumption remains constant throughout the life-span. Saving remains positive through the working life to permit the accumulation of sufficient assets to maintain the previous consumption standard throughout retirement. The two shaded areas must be equal. The total assets held at any time t can be estimated by the shaded areas to the left of a vertical line erected on the chosen time t provided we remember to count the post-retirement shaded area as negative. In this way we see that the accumulation of assets does not in itself induce further con-

¹ Henceforth we shall refer to this hypothesis as the Modigliani hypothesis for short.

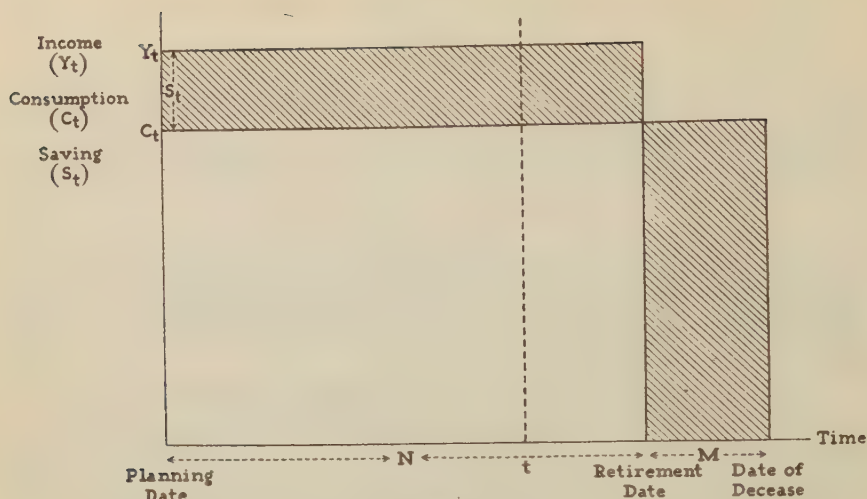


fig. 2.1

sumption since assets are set aside deliberately as part of the life plan to finance retirement years.

The theory possesses several important features. The first is that the length of the planning horizon (L_t) enters the functional relationship in an essential way. This aspect has received little attention in empirical work. Secondly, all expected future incomes play some part in the analysis, whereas much work, both empirical and theoretical has stressed the role of current income only. Thirdly, the total of assets at the beginning of each time period replaces the money and security holdings that are regarded as the significant variables in some earlier treatments.

On the simplified hypothesis, remaining life-span enters as a divisor of the income and asset terms, but it does not enter linearly. Even if we relax assumption VI it still enters as a divisor of total resources but this divisor may be quite complicated and dependent upon the coefficients of the utility function, which by assumption IV is assumed to be homogeneous of any degree.

What light does equation (2.3) throw on the marginal propensity to save? Defined as the change in savings consequent upon changes in income, *cet. par.*

$$\frac{\partial S}{\partial Y} = 1 - \frac{1}{L_t} \quad (2.4)$$

That is to say it depends solely on L_t , the remainder of the life-span, and is higher when L_t is large, *i.e.* at young ages. But this leads to marginal propensities which are manifestly too large. The obvious reason is that

we have assumed $\frac{\partial Y^e}{\partial Y}$ to be zero: that is to say, we have assumed that a

change in current income does not lead to any modification of income expectations. This is not plausible and we should normally expect current

expectations to be revised when current income changes, *i.e.* $\frac{\partial Y^e}{\partial Y}$ to be greater than zero and positive. Consequently we redefine

$$\frac{\partial S}{\partial Y} = \frac{L_t - 1}{L_t} - \frac{N - t}{L_t} \frac{\partial Y^e}{\partial Y} \quad (2.5)$$

Modigliani and Brumberg expect $\frac{\partial Y^e}{\partial Y}$ to lie between 0 and 1 but there seems no obvious reason why this should be so, especially early in the earning span. However, this may serve as a working hypothesis even though it may not be altogether safe to assume that $\frac{\partial Y^e}{\partial Y}$ is independent of current income, let alone constant.

Cross-section propensities to consume do not provide direct estimates of individuals' marginal propensities. For the individual, the marginal variation in 'beginning of period' asset holdings consequent upon a change in income is zero, but as Modigliani and Brumberg demonstrate for the case of a cross-section where all households are anticipating constant incomes throughout the earning span, possess no initial assets and expect no windfalls, assets at any time t will be

$$a_t = \frac{(t-1)M}{L} Y \quad (t=1, 2, \dots, N) \quad a_t = \frac{(L+1-t)N}{L} Y \quad (t=N+1, \dots, L) \quad (2.6)$$

provided expectations are fulfilled.¹ M denotes the retirement span, *i.e.* $L-N$.

Thus the value of $\frac{\partial a_t}{\partial Y}$ in such a stationary cross-section depends upon age and when this dependence is recognized it can be shown that the cross-section marginal and average propensities to consume prior to retirement are $\frac{M}{L}$, independent of both age and income, whereas the individual propensities depend upon age.

The cross-section marginal and average propensities to save will be independent of income if the following conditions are satisfied: assumption (IV) is given, $\frac{\partial Y^e}{\partial Y}$ is independent of Y , initial assets are zero and expectations

at the commencement of the planning period are fulfilled.

Modigliani and Brumberg rewrite the individual savings relation in a manner which facilitates discussion of the effects of a change in income from the level to which the individual has become adjusted.

$$\text{Thus}^2 \quad S = \frac{M}{L} Y + \frac{N(L-t)-M}{LL_t} (Y - Y^e) - \frac{1}{L_t} \left\{ a - a(Y^e, t) \right\} \quad (2.7)$$

¹ Modigliani, *op. cit.*, p. 401. Planning is assumed to take place at age 1, which denotes the beginning of 'active life', *i.e.* of the earning span.

² When suffixes are suppressed it may be understood that reference is to the current period.

$a(Y^e, t)$ denotes the assets that would be held at the beginning of the current period by an individual fully adjusted to a continuing income level, Y^e ; a denotes actual initial asset holdings.

The effects of a change in current income under different situations may now be distinguished. We shall consider two of these.

(1) Where the income change does not affect income expectations. The saving-income ratio will rise, the second term in (2.7) becoming positive. This rise will be the more marked the higher the percentage increase in income.

(2) Where the income change does affect future income expectations. If $\frac{\partial Y^e}{\partial Y} = 1$, the second term equals zero but the saving-income ratio rises

because the third term is positive. Assets are now deemed insufficient in view of the revised income outlook.

The following arithmetical illustration serves to indicate that, for equal increases in current income in these alternative situations, the saving-income ratio will rise more markedly in the former case in the first period after the income change, but thereafter will lie below its own previous value. In the latter case the saving-income ratio rises to a new level which is maintained until retirement, but this level is less than the highest reached in the former case.

For example, let planning take place at age one. The individual is assumed to behave in accord with Modigliani-Brumberg assumptions I—VI.

EARNING SPAN

	Year	1	2	3	4	5*	Total Expected Resources	
I. Income		100	100	100	100	—	400	} $\frac{S}{Y}$ ratio 20.0%
Consumption		80	80	80	80	80	400	
II. Transitory change in income in 2nd year		100	105	100	100	—	405	} $\frac{S}{Y}$ ratio 2nd year 22.6% thereafter 18.75% until retirement
Consumption		80	81½	81½	81½	81½	405	
III. Permanent change in income in 2nd year		100	105	105	105	—	415	} $\frac{S}{Y}$ ratio 2nd and sub- sequent years up to retirement 20.24%
Consumption		80	83½	83½	83½	83½	415	
IV. If permanent change had held from outset		105	105	105	105	—	420	} $\frac{S}{Y}$ ratio 20.0%
Consumption		84	84	84	84	84	420	
IIa. Transitory change in income in 3rd year		100	100	105	100	—	405	} $\frac{S}{Y}$ ratio 3rd year 22.2% thereafter 18.33% until retirement
Consumption		80	80	81½	81½	81½	405	
IIIa. Permanent change in income in 3rd year		100	100	105	105	—	410	} $\frac{S}{Y}$ ratio 3rd year 20.63% up to retirement
Consumption		80	80	83½	83½	83½	410	

* A single year of retirement assumed, the fifth.

This hypothesis helps to explain the observed features in cross-section samples for members of a given age-group. Mapping savings on the vertical axis, income on the horizontal axis,¹ we measure off by lines parallel to the saving-axis the quintiles of the income distribution and insert point *P* which

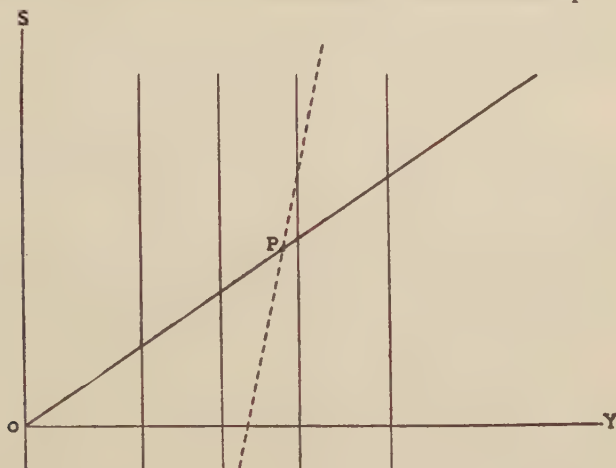


fig. 2.2

represents the mean income and savings for the group $(\bar{Y}, \bar{S})$. On this hypothesis we should expect more of those in receipt of incomes higher than had been expected to be congregated in the groups to the right of $\bar{Y}$, those with lower incomes to the left. This should tend to make the line joining the mean incomes and savings of each income quintile² steeper than that joining $(\bar{Y}, \bar{S})$ to the origin. Moreover, the higher (lower) income brackets are likely to contain a greater proportion of those who now entertain more (less) favourable income expectations than before. The actual slope of the curve joining mean points of the quintiles will depend on three factors :

- (1) whether the income change is or is not expected to continue,
- (2) the size of the change,
- (3) the precise effect on income expectations of a non-temporary income variation.

The Modigliani hypothesis also presents propositions which can be tested about the relation between an individual's savings and age. The nearer to retirement an individual is at the time of an income increment, the less will the saving-income ratio rise if that change does not affect income expectations. If, on the other hand, income expectations change and we

assume $\frac{\partial Y^e}{\partial Y} = 1$, the saving-income ratio will become greater the nearer to

retirement the income increment occurs. These features are brought out in our table when IIa and IIIa are compared with II and III.

¹ In Fig. 2.2 the scale of the savings axis is very much greater than that of the income axis,

² Illustrated by the broken line in Fig. 2. 2.

It of course follows directly from (2.2) that the consumption-net worth ratio rises with age, with given income and income expectations.

These are the essential implications of the hypothesis, but it may be helpful to bear two derived results in mind.

(1) If we assume expected income grows at a constant rate (g) (expectations being always fulfilled) and if we also assume consumption to grow at this rate and initial assets to be zero, the cross-section saving-income relation becomes :

$$S'_\tau = \left\{ \frac{(1+g)^L - (1+g)^N}{(1+g)^L - 1} \right\} Y_\tau \quad \text{for any age before retirement.} \quad (2.8)$$

This may prove to be a better norm for empirical work than that advanced by Modigliani and Brumberg.

(2) The release of assumption III will mean that the consumption-income relationship will no longer pass through the origin unless assets at death are assumed to bear some neat relation to total resources, such as—

$$a_{L+1} = \gamma_{L+1} V_t \quad (2.9)$$

which gives :

$$C'_\tau = \left\{ \frac{1 - \gamma_{L+1}}{L_t} \right\} V_t \quad (2.10)$$

As presented, the theory might be described as the bachelor theory of saving. We shall endeavour to broaden the analysis by allowing for variations in the composition of the family over the life-span.

We continue to endow the head of family with perfect foresight as to the length of his life-span, and add to this precise knowledge as to changes in family composition over that period. We modify assumption (IV) to read :—

The proportion of total resources that the individual plans to consume in any given year of his life is determined by his (and his family's) tastes and the number in the family, and not by the size of his resources.

We subdivide the parameter γ of the previous formulation into two parts, one of which varies with the size of the household while the other does not.

$$\gamma_\tau^t = \gamma_\tau'^t + \beta_\tau'' (J_\tau^t - 1) \quad (2.11)$$

where J_τ^t is the number expected to be in the family in period τ .

In lieu of assumption VI we assume—

$$\gamma_\tau'' = \gamma' \text{ and } \beta_\tau'' = \beta' \quad (2.12)$$

Denoting the number of periods in which J members are in the family by L^j we can tabulate the appropriate coefficients

L^1	γ'	
L^2	$\gamma' + \beta' (1)$	
L^3	$\gamma' + \beta' (2)$	
...	...	...
...	...	...

and

$$\sum_j L^j = L_t$$

From the revised assumption (IV) we have

$$\begin{aligned} C_{\tau}^t &= \gamma_{\tau}^t V_t \\ \sum_{\tau=t} C_{\tau}^t &= \left(\sum_{\tau=t} \gamma_{\tau}^t \right) V_t = V_t \\ \sum_{\tau=t} \gamma_{\tau}^t &= L^1 \gamma' + L^2 (\gamma' + \beta') + L^3 (\gamma' + 2\beta') + \dots \\ &= \gamma' (L^1 + L^2 + L^3 + \dots) + \beta' (L^2 + 2L^3 + \dots) \\ &= L_t \gamma' + \beta' \sum_j L^j (J_{\tau}^t - 1) = 1 \end{aligned} \quad (2.13)$$

We may rewrite this last expression $\beta' L_t (\bar{J}^t - 1)$ where $\bar{J}^t$ is the weighted mean of the numbers in the family in each time period, the weights being the L^j ,

$$\text{Then} \quad \gamma' = \frac{1 - \beta' L_t (\bar{J}^t - 1)}{L_t} = \frac{1}{L_t} - \beta' (\bar{J}^t - 1) \quad (2.14)$$

Adding $\beta' (J_{\tau}^t - 1)$ to both sides, we obtain

$$\begin{aligned} \gamma' + \beta' (J_{\tau}^t - 1) &= \frac{1}{L_t} - \beta' (\bar{J}^t - J_{\tau}^t) \\ C_{\tau}^t &= \left\{ \frac{1}{L_t} - \beta' (\bar{J}^t - J_{\tau}^t) \right\} V_t \end{aligned} \quad (2.15)$$

If we admit an estate motive and assume that the head of the family wishes to leave a bequest, which varies with the expected family size at the time of his decease (J_{L+1}^t), we might write—

$$a_{L+1} = \gamma_{L+1} V_t = \{ \gamma_{L+1}^t + \beta_{L+1}^t (J_{L+1}^t - 1) \} V_t \quad (2.16)$$

The consumption function will then read —

$$C_{\tau}^t = \left\{ \frac{1 - \gamma_{L+1}^t - \beta_{L+1}^t (J_{L+1}^t - 1)}{L_t} - \beta' (\bar{J}^t - J_{\tau}^t) \right\} V_t \quad (2.17)$$

Neglecting these complications we may write the current period saving function corresponding to (2.15).

$$S_t^t = \left\{ 1 - \frac{1}{L_t} + \beta' (\bar{J}^t - J_t) \right\} Y_t - \left\{ \frac{1}{L_t} - \beta' (\bar{J}^t - J_t) \right\} \{ (N-t) Y^e + a_t \} \quad (2.18)$$

The nature of certain of the assumptions underlying these expressions must be made explicit.

Firstly, we assume that the net effect on consumption is the same whether the family is augmented by marriage or by a child. If twins are born the effect on current consumption is twice that of a single birth. We have ignored the qualitative effect of a change in family size by age and sex.¹

Secondly, we assume that an increase in family size by one person changes consumption by the same proportion as would a decrease by one person, though a strong case might be made out for irreversible relationships.

Thirdly, we assume that the net effect on consumption resulting from a unit change in family size is invariant over the period during which the

¹ In this paragraph we assume that mean expected family size is unaffected by current changes in family size.

family remains of the resulting size. Once again it might be cogently argued that expenditures tend to be higher at the beginning and end of the period—that is, when changes take place—than in the centre of the relevant period.

In a cross-section of households satisfying the stationary equilibrium conditions, with the additional *proviso* that the number in the family remains constant throughout the life-span, we obviously arrive at the same saving-income and asset-income relations as given on p. 221.

Of more immediate interest is what we can infer about an individual's saving-income ratio consequent upon a change in family size. It is convenient to assume stationary equilibrium conditions, thereby continuing to ignore any impact of family size on earnings. Then the savings and accumulated assets relationships at time τ are

$$S_{\tau}^i = \left\{ \frac{M}{L_t} + N_t \beta' (\bar{J}^i - J_{\tau}^i) \right\} Y_i \quad (N_t = N + 1 - t) \quad (2.19)$$

$$a_{\tau}^i = \left[(\tau - t) \left\{ \frac{M}{L_t} + N_t \beta' (\bar{J}^i - {}_{\tau}\bar{J}^i) \right\} \right] Y_i \quad (2.20)$$

where ${}_{\tau}\bar{J}^i$ denotes mean family size up to the commencement of period τ .

If the size of the family is currently less than the head of the family expects on average over the life-span, the saving-income ratio will be higher than where the contrary is true. Moreover, if the average size of the family has to date been less than the average expected over the lifetime of the head of the family, the asset-income ratio will be greater, other things being equal, than where the contrary is true.

Once again, it is the implications of this analysis for a cross-section that concern us. In young age-groups, under stationary income conditions, the saving-income ratio will tend to be higher than in middle age-groups through the influence of the family size effect and will tend to rise again to some extent in the pre-retirement age-groups. The precise effects in these and other age groups depend upon the parameter β' which would have to be estimated from suitable data.

With these extensions we have a hypothesis that brings into relief the roles assigned to incomes, assets, age and family composition. Moreover, once we recognize the interdependence between assets and incomes in a cross-section we are in a position to employ cross-section data directly to test the hypothesis. *The Friedman hypothesis*

Friedman's hypothesis stems from traditional utility theory and, as with Modigliani's, the utility function is assumed to be homogeneous in consumption over time. Planned consumption may then be shown to depend upon expected resources at the planning date and anticipated rates of interest¹ in such manner that—

$$C_{\tau}^i = k' (i, u) V_i \quad (2.21)$$

Friedman defines income as the amount a consumer unit can consume. The consumption/expected resources ratio depends upon the rate of interest (i) and utility characteristics (u) but not upon the level of expected resources.

¹ See K. E. Boulding: *Economic Analysis*, 3rd Ed., London, 1955, p. 826–8 for the proof in the case where no restrictions are placed upon the consumption function.

Friedman defines income as the amount a consumer unit can consume while keeping its wealth intact. Income—or permanent income as he chooses to designate it—equals iV_i

(2.21) may now be rewritten—

$$C_{\tau}^e = k(i, u) iV_i = k(i, u) Y_{P\tau}^e = C_{P\tau}^e \quad (2.22)$$

where $C_{P\tau}$ is permanent consumption and $Y_{P\tau}$ is permanent income at time τ . Permanent consumption as a proportion of permanent income depends on utility factors and the rate of interest, but not on the level of permanent income. Moreover, the level of current observed income has no direct influence on consumption patterns save insofar as it is an adequate indicator of permanent income.

So far the two hypotheses are broadly similar. In the Friedman formulation, however, there is no explicit mention of the planning horizon, which need not necessarily accord with the remaining life-span, nor is it assumed that any complete disposition of wealth takes place over any specified span. Rather is the emphasis upon keeping wealth intact. This treatment would seem to go some way towards meeting objections to lifespan planning voiced by Prof. J. R. Hicks.¹ Friedman also discusses the impact of uncertainty upon the consumption plan. To the two motives for holding assets under certain expectations—the levelling out of consumption over time and the earning of income from property—is added a third, the need for a reserve against unforeseen contingencies. Faced with uncertainty individuals hold assets and, Friedman assumes, the crucial factor to consider is the asset/permanent income ratio. Expressing the ratio of assets to permanent income by w , this is now incorporated in the function k and we may rewrite (2.22)

$$C_P = k(i, w, u) Y_P \quad (2.23)$$

The higher is w , the less is the need for additional reserves and the greater consumption becomes. This aspect will be examined more thoroughly in a later section.

The variables of the theory have no direct counterpart in observed magnitudes and some bridge must be erected between them. Friedman assumes that observed or measured income and consumption are composed of two parts²—a permanent component corresponding to the theory and a transitory component such that—

$$Y = Y_P + Y_T; \quad C = C_P + C_T \quad (2.24)$$

The suffix T denotes transitory values.

Friedman has no wish to affix hard and fast definitions to these components, preferring that the division between them should be decided by the data themselves. Transitory components, in the main, include accidental occurrences such as an unusually bad winter which reduces the earnings from sale of crops, or severe sickness which affects both income and consumption.

In order to be able to test the hypothesis against observed data he makes the following assumptions concerning the correlation of the permanent and transitory components.

$$\rho(Y_P Y_T) = \rho(C_P C_T) = \rho(C_T Y_T) = 0 \quad (2.25)$$

¹ J. R. Hicks, *Value and Capital*, Oxford, 1939, Chap. XVIII.

² See M. Friedman, *Income from Independent Professional Practice*, pp. 325–38, 352–64.

The transitory component of a variable is assumed to vary independently of the permanent component of that variable and also of the transitory component of the other variable. The last-mentioned is the strong assumption. For example, it implies that if a person receives a windfall it will not be consumed. Consumption in this context means single-use goods and the current services received from durables owned, so that the spending of the windfall on durables need not violate the assumption. In any case, the receipt of a windfall is an addition to wealth and therefore increases permanent income, and it is only the excess of the windfall over the increment in permanent income that constitutes transitory income. The assumption states that this excess will not affect current consumption.

Given a cross-section of households selected in such a way that they are expected to behave as if they had the same elements of k , we may estimate by least-squares the parameters of a linear relation between measured consumption and income.

$$C = \alpha + \beta Y \quad (2.26)$$

Friedman argues that we may then use his theory to interpret the estimates of α and β .

He shows that $b = \text{est. } \beta = kP_Y$ (2.27)

$$a = \text{est. } \alpha = \bar{C}_T - kP_Y \bar{Y}_T + k(1 - P_Y) \bar{Y}_P \quad (2.28)$$

The new symbol P_Y represents the proportion of the variance of measured incomes in the cross-section attributable to the permanent component of incomes :

$$\frac{\Sigma (Y_P - \bar{Y}_P)^2}{\Sigma (Y - \bar{Y})^2} \quad (2.29)$$

It must lie between 0 and 1; $P_Y = 1$ indicates that $\Sigma (Y_T - \bar{Y}_T)^2 = 0$, *i.e.* the dispersion of the transitory income components is zero; $P_Y = 0$ indicates that $\Sigma (Y_P - \bar{Y}_P)^2 = 0$, *i.e.* that dispersion of the permanent income components is zero (provided that in each case the variance of observed incomes remains finite).

The slope of the consumption-income regression line is a multiple of two factors k and P_Y . The former is the proportion of permanent income that members of the group choose to spend on consumption, the latter a measure of the degree to which changes in people's current observed incomes are associated with changes in their permanent incomes, which are the main influence on consumption.

Since $C_P = kY_P$, if we can assume that $\bar{C} = \bar{C}_P$ and that $\bar{Y} = \bar{Y}_P$ (2.30), *i.e.* that the mean transitory consumption and income components for a group are zero, the average cross-section propensity to consume will be k and the marginal divided by the average cross-section propensity to consume will be P_Y .

Similarly, on these assumptions the average cross-section propensity to save is $1 - k$ and the corresponding marginal propensity $1 - kP_Y$.

Figure 2.2 can also be used to interpret the Friedman hypothesis. The slope of the line joining P to the origin is $1 - k$, that of the regression line is $1 - kP_Y$.

The cross-section average propensities to save

These hypotheses have certain implications for the interpretation of cross-section data, and the more important of them are summarized below. We shall then proceed to assess the degree of empirical support accorded the theories.

Firstly, from the Modigliani hypothesis, we may infer that, for a cross-section of individuals still within the earning span and completely adjusted to stationary income conditions, the cross-section average propensity to save will be constant, quite independently of age. Alternatively, if we assume non-stationary income conditions and adopt the simple hypothesis proposed by Modigliani¹ for expressing mean expected income and assets as functions of current income and the elasticity of income expectations, we find it is not possible to impose qualitative restrictions upon the variation of the average propensity to save with respect to age. These deductions are based upon assumptions I—VI. If we assume that individuals are adjusted to regularly progressive income conditions and plan to increase consumption at the same rate as income grows, the cross-section average propensity to save is again constant, its value depending upon the rate of growth of income.

But these conclusions take no account of variations in family size. We should expect the average propensity to save to be higher when the numbers in the household are less than the expected lifespan average; that is, when the head of the family is young or approaching retirement. If we assume that all families follow a more or less similar life pattern, the *cross-section* average propensities to save, other things equal, should also be higher in young and near-retirement age groups than at other ages.

It may also be shown that during the earning span the cross-section average propensity to save for any age-group decreases as the elasticity of income expectations increases, except under certain very improbable conditions.

Friedman's hypothesis is not specific about the variation of the average propensity to save with age and family size. If it can be assumed for a cross-section group that mean transitory consumption and income components are zero, the average propensity to save will be $1 - k$, which, depends upon the interest rate, utility factors and the ratio of assets to permanent income. The greater the variability of income, the larger the necessary reserve. This need of a greater permanent asset/income ratio, other things equal, reduces the permanent consumption/income ratio.

These implications of the theories relate to certain theoretical definitions of savings and income which cannot be closely approximated from our survey material. In the survey we have obtained estimates for two concepts of savings—one including, the other excluding, durable goods expenditures within the year. The components of savings net of durable goods expenditure—designated S —are given in appendix D. It will be observed, however, that S includes one important form of durable goods expenditure—housing. The alternative definition, savings plus durable goods expenditure—designated S' —at least has the merit of treating nearly all durable goods

¹ Modigliani, *op. cit.*, p. 413.

expenditure on an equal footing. Even so, because of practical difficulties, purchases of durables costing less than £25 were excluded. The definition of savings implicit in the Friedman and Modigliani hypotheses differs from that employed in the survey by the addition of superannuation contributions by employers on behalf of their employees, social insurance contributions destined for individuals on retirement together with the individual portion of earnings on all pensions and security funds, net capital gains during the year, gifts and other capital transfers. There are also two important deductions—current depreciation on durable goods, including houses, and receipts from Assurance and Pension funds.

Even our estimates of savings in terms of the survey definitions contain certain weaknesses. Thus, it is not possible to ascertain reliably additions to currency holdings and these have been excluded. Moreover, since income is defined net of capital transfers these have to be excluded from savings also. Whereas for the group as a whole this can be done by straightforward deduction of net capital inflows from savings totals, reliance being placed upon cancelling out across the group, for any particular sub-group (the individual family being the limiting case) this assumption may well be invalid.

Alternative definitions of income are needed to ensure correspondence with the theoretical measures of savings. Net income from *all* durable goods (not merely an approximation for housing alone), contributions to Assurance and Pension funds by employers on behalf of employees, plus interest on such funds 'earmarked' for individuals, that portion of taxation destined to provide a claim on the state for retirement, and similar pensions should be incorporated in the net income measure, together with appropriate adjustments for capital transfers. On the other hand benefits from Assurance and Pension funds, together with those from State Security Schemes should be excluded from the income measure though they are retained in the survey estimates.

There seems little doubt that our measure of current income provides downward-biased estimates of 'measured' income as implied by the two theories. But it is not easy to make equally helpful statements with regard to saving. At young ages S' probably accords more closely to the theoretical definition as the depreciation of existing assets should at this stage be small. But at near retirement ages this latter component might be sufficiently large to make S the more apposite measure, though if we follow this line of argument we do not know at which stage the shift from one measure to the other should be made. In any event a change of definition at, say, age group 45–54, would almost certainly exaggerate the variation across contiguous age groups.

But it is the mean-saving/mean-income ratios we are primarily interested in. Since, as age advances, the downward bias of our estimate of net income will become more pronounced, our estimates of the ratios will be upward biased on this account—a further reason for the treatment of $\frac{\bar{S}}{\bar{Y}}$ as the more appropriate ratio in the upper age groups. On the opposite side, the neglect of superannuation payments by employers in both savings and income

estimates imparts a downward bias to the ratios—a bias that probably increases as retirement approaches.¹

All in all, it seems probable that $\frac{\bar{S}'}{\bar{Y}}$ sets more or less an upper bound to the ratio, while $\frac{\bar{S}}{\bar{Y}}$ becomes a more apposite measure of the savings-income ratio of the theories as retirement age is approached. It is doubtful therefore whether for age and family size effects at least, either of the $\frac{\bar{S}}{\bar{Y}}$ and $\frac{\bar{S}'}{\bar{Y}}$ ratios should be used alone for testing. If our presuppositions are justified we should expect the $\frac{\bar{S}}{\bar{Y}}$ ratio to become increasingly upward biased with advancing age and thus exaggerate any upward trend in the underlying ratio.

Although the results for Retired and Unoccupied and those for heads of income units 65 years of age and over are generally included in the subsequent tables, virtually no attention will be paid to them. By age 65 at the latest, the bulk of those previously in the working groups will have been transferred to the retired category and will so augment this group that a lifespan study of those who are permanent members of the group becomes impossible. Moreover, those who remain in employment after age 65 are probably not typical in saving motivations of those who work until 65 and then retire in the ordinary way. It seems advisable to confine discussion to more homogeneous groupings.

The data have been segregated in a two-way classification by age and occupation groupings.

<i>Occupation</i>	<i>Age Groups</i>	
	Age Range	Code No.
Manual	18—24	1
Clerical and Sales	25—34	2
Managerial	35—44	3
Self-employed	45—54	4
Retired and Unoccupied	55—64	5
	65 and over	6

The $\frac{\bar{S}}{\bar{Y}}$ ratios for each of the occupation groups provide some evidence of a rising trend with age though we have argued that at young ages this ratio is an under-statement of the theoretical saving-income ratios. In the $\frac{\bar{S}'}{\bar{Y}}$ ratios the trend is downward save for the self-employed, even though our estimates should tend to promote an upward tilt. The expected dip in the $\frac{\bar{S}'}{\bar{Y}}$ ratio at the stage when families are of peak size is clearly evident in the Manual, Clerical and Sales and Managerial groups, though it is interesting

¹ These adjustments are probably of less importance for Manual and Clerical and Sales groups than for Managers.

TABLE 2.1
Summary Characteristics

Age Group	$\bar{S}$ $\bar{Y}$	$\bar{S}'$ $\bar{Y}$	$\bar{K}$ $\bar{Y}$	$\bar{J}-J$	$\frac{\bar{DC}}{\bar{Y}}$
Manual					
1 (18-24)	.0120	.0470	.0516	-1.5	.0350
2 (25-34)	-.0075	.0737	.1837	+ .26	.0812
3 (35-44)	.0098	.0517	.1794	+ .96	.0419
4 (45-54)	-.0019	.0388	.3588	+ .11	.0407
5 (55-64)	.0283	.0382	.3610	- .74	.0099
6 (65 and over)	-.0990	-.0634	.8437	- .95	.0356
Clerical and Sales					
1 (18-24)	.0076	.0315	.1671	- .87	.0239
2 (25-34)	-.0155	.0554	.2019	+ .24	.0709
3 (35-44)	-.0483	.0276	.3086	+ .82	.0759
4 (45-54)	.0200	.0667	.4448	+ .25	.0467
5 (55-64)	.0109	.0285	.7187	- .07	.0176
6 (65 and over)	.0438	.0707	1.1528	- .42	.0269
Managerial					
1 (18-24)	-.0370	.0842	.3439	-1.47	.1212
2 (25-34)	-.0168	.1865	.5850	- .26	.2033
3 (35-44)	.0507	.1465	.3902	+ .89	.0958
4 (45-54)	.0574	.1304	.9846	- .25	.0730
5 (55-64)	.0500	.1036	1.1161	- .69	.0536
6 (65 and over)	-.2731	.0620	1.2377	- .43	.3351
Self-employed					
1 (18-24)	—	—	—	—	—
2 (25-34)	.1979	.2557	.4079	+ .42	.0578
3 (35-44)	.2140	.2636	.4424	+ .22	.0496
4 (45-54)	.0103	.1093	1.3646	+ .11	.0990
5 (55-64)	.3010	.3290	.3784	- .73	.0280
6 (65 and over)	.1302	.1873	.9422	- .92	.0571
Retired and Unoccupied					
1 (18-24)	-.0150	.0173	.6030	- .47	.0323
2 (25-34)	-.0375	.0703	.3247	+ 1.18	.1078
3 (35-44)	-.0014	.0054	.2932	+ 1.61	.0068
4 (45-54)	-.1706	-.1379	.8398	+ .71	.0327
5 (55-64)	-.1212	-.0949	1.5371	- .20	.0263
6 (65 and over)	-.0905	-.0752	1.4003	- .12	.0153
All Groups					
1 (18-24)	.0088	.0430	.1093	-1.12	.0342
2 (25-34)	.0004	.0923	.2465	+ .45	.0919
3 (35-44)	.0282	.0831	.2541	+ 1.17	.0549
4 (45-54)	.0061	.0577	.5848	+ .32	.0516
5 (55-64)	.0214	.0410	.6703	- .56	.0196
6 (65 and over)	-.0854	-.0435	1.2187	- .92	.0419

to note that with the exception of Clerical and Sales there is no subsequent recovery in the $\frac{\bar{S}'}{\bar{Y}}$ ratio. This may suggest a sustained downward drift in the cross-section average saving propensities for, as it were, single men being partly offset by the impact of family size variations. This, however, is only one of several plausible explanations.¹

Durable goods expenditures comprise only one part of our savings aggregate (and some at least is more correctly designated consumption) and the

¹ One factor that is a form of investment in human capital—education expenses—appears on our definitions as consumption. The omission of this item may help to explain why the $\frac{\bar{S}}{\bar{Y}}$ ratios for Managers do not rise with age more steeply.

theories under consideration do not offer any direct hypotheses as to its behaviour. But one might surmise that this form of saving would be of somewhat greater importance in the young age groups when homes are being set up and family numbers are growing. Our *a priori* expectations might then be for a parabolic shaped curve for $\frac{DC}{\bar{Y}}$ with a peak when family

size is at a maximum. For Manual and Managerial the peak precedes by one age group that with the maximum family size, but for Clerical and Sales it lies in the same group. The exception is the Self-employed, who do not appear to fit in with our expectations as to the behaviour of the cross-section saving-income ratio either. To this we shall shortly return. For other groups the general pattern of durable goods expenditure/income ratios accords with expectations, there being, however, a greater relative concentration on durable goods expenditure by Managers at young ages than by others. This early rise in $\frac{DC}{\bar{Y}}$ and subsequent fall taken in conjunction with the expected movement in total savings/income would suggest that other forms of saving would be low when DC is large, and *vice versa*. There is quite striking evidence to this effect borne out by a comparison of $\frac{\bar{S}}{\bar{Y}}$ and $\frac{DC}{\bar{Y}}$.

We turn to inter-occupation differences for given age groups. These should shed light on the income variability hypothesis. The $\frac{\bar{S}'}{\bar{Y}}$ ratios are appreciably greater for Managers and Self-employed than for the remainder and this is also true of $\frac{\bar{S}}{\bar{Y}}$ in age groups 3 and 5. To the extent that it can be shown from outside evidence that Managers and Self-employed experience more income instability than other groups, the Friedman hypothesis is supported. *A priori* we can accept the view that the income instability of Self-employed will be greater than for other groups but the case for Managers needs to be 'proven'.

In the Self-employed group different motivations appear to be at work. We may ask ourselves two questions: why are the saving-income ratios high in the peak family size age bracket? and why are the ratios so low in the 45-54 age bracket? An answer to the former is provided by the income variability hypothesis. Self-employed will always expect to be confronted with much uncertainty, but this will undoubtedly be greater when they are setting up in business and when, through increasing age, they endeavour to counter declining resilience. This would suggest that the saving-income ratios would be swollen at young and near retirement ages with a period of more tranquil trading conditions in between.¹ But we have still to face up to the second question.

¹ This conclusion would have to be modified if fluctuations in general economic activity were considerable. But our observations relate to a period of favourable trade only.

TABLE 2.2
Summary Characteristics

Occupation	$\bar{S}$ $\bar{Y}$	$\bar{S}'$ $\bar{Y}$	$\bar{L}$ $\bar{Y}$	$\bar{J}-J$	$\frac{\overline{DC}}{\bar{Y}}$
Age Group 1 (18-24)					
Manual	.0120	.0470	.0516	-1.50	.0350
Clerical and Sales	.0076	.0315	.1671	-.87	.0239
Managerial	-.0370	.0842	.3439	-1.47	.1212
Self-employed	—	—	—	—	—
Retired and Unoccupied	-.0150	.0173	.6030	-.47	.0323
Age Group 2 (25-34)					
Manual	-.0075	.0737	.1837	+.26	.0802
Clerical and Sales	-.0155	.0554	.2019	+.24	.0709
Managerial	-.0168	.1865	.5850	-.26	.2033
Self-employed	.1979	.2557	.4079	+.42	.0578
Retired and Unoccupied	-.0375	.0703	.3247	+1.18	.1078
Age Group 3 (35-44)					
Manual	.0098	.0517	.1794	+.96	.0419
Clerical and Sales	-.0483	.0276	.3086	+.82	.0759
Managerial	.0507	.1465	.3902	+.89	.0958
Self-employed	.2140	.2636	.4424	+.22	.0496
Retired and Unoccupied	-.0014	.0054	.2932	+1.61	.0068
Age Group 4 (45-54)					
Manual	-.0019	.0388	.3588	+.11	.0407
Clerical and Sales	.0200	.0667	.4448	+.25	.0467
Managerial	.0574	.1304	.9846	-.25	.0730
Self-employed	.0103	.1093	1.3646	+.11	.0990
Retired and Unoccupied	-.1706	-.1379	.8398	+.71	.0327
Age Group 5 (55-64)					
Manual	.0283	.0382	.3610	-.74	.0099
Clerical and Sales	.0109	.0285	.7187	-.07	.0176
Managerial	.0500	.1036	1.1161	-.69	.0536
Self-employed	.3010	.3290	.3784	-.73	.0280
Retired and Unoccupied	-.1212	-.0949	1.5371	-.20	.0263
Age Group 6 (65 and over)					
Manual	-.0990	-.0634	.8437	-.95	.0356
Clerical and Sales	.0438	.0707	1.1528	-.42	.0269
Managerial	-.2731	.0620	1.2377	-.43	.3351
Self-employed	.1302	.1873	.9422	-.92	.0571
Retired and Unoccupied	-.0905	-.0752	1.4003	-.12	.0153

On the Friedman hypothesis the average saving/income ratios are influenced in addition by two other variables—the rate of interest and, as a means of offsetting effects of uncertainty, the asset/income ratio. As a proxy for the latter we employ the mean liquid asset/mean income ratio. Liquid assets, it may be argued, are an important form of asset holding in the face of uncertainty though they lose much of their attractiveness in times of inflation. However, we must not forget that assets are also accumulated for maintaining consumption in retirement. This aspect is less easily detected in Friedman's treatment since accumulated assets are incorporated in expected resources and influence savings *via* permanent income.

The $\frac{\bar{L}}{\bar{Y}}$ ratios tend to rise fairly uniformly with age for occupation groups other than the Self-employed. Moreover this movement is not associated in the

cases of Manual and Clerical and Sales with essentially parallel changes in the consumption-income ratios. This is in broad agreement with the lifespan planning thesis. Besides, the ratios tend to be higher for Managers and Self-employed than for others, a feature which accords well with the degree of support already found for the income variability hypothesis but which is subject to the same qualifications.

As we shall spell out in more detail in subsequent sections, asset/income ratios higher than those considered necessary tend to raise the consumption-income ratio, and *vice versa*. If we consider the $\frac{\bar{L}}{\bar{Y}}$ ratios for the Self-employed and average them across age groups, we find that the values for age groups 2, 3 and 5 are below average, that for group 4 very much above. This higher than 'normal' $\frac{\bar{L}}{\bar{Y}}$ ratio might be expected to raise the average consumption income ratio appreciably and perhaps the durable goods/income ratio also. The results for Self-employed in age group 4 suggest that this sort of reaction is taking place and this may serve as a plausible answer to our second question. We should explain the behaviour in this group as follows. Members of this group are enjoying a period of relative steadiness in their business experience and immediate expectations. There is less need for the maintenance of as high an average holding of assets relative to income as in the immediate past—a ratio which in any event appears to have become excessive. Emphasis is therefore shifted towards greater expenditure on consumption.

On somewhat similar grounds, we may account for the association of a relatively low $\frac{\bar{L}}{\bar{Y}}$ ratio in Managers age group 3 with a greater $\frac{\bar{S}'}{\bar{Y}}$ ratio than that of group 4, this aspect tending to offset the downward pressure on $\frac{\bar{S}'}{\bar{Y}}$ associated with peak family size. But as far as Managers are concerned this statement is subject to our earlier reservations.

If our explanation in terms of income variability of Managers is not accepted, accounting for the observed results becomes somewhat elusive. *Prima facie*, it might be thought that these ratios are greater because average absolute income is greater, but such a 'Keynesian' explanation is not supported by a comparison of the $\frac{\bar{S}'}{\bar{Y}}$ ratios across age groups nor by a comparison of results of Managerial and Self-employed groups. Those aspects of these theories which relate to the impact of income variability and uncertainty *via* the asset-income ratio receive at least conditional support from our data. On the influence of family size and especially of age our data are not as informative.

The cross-section marginal propensities to save

For a cross-section of households within the earning span the Modigliani hypothesis tells us that under 'stationary' income conditions the marginal

propensity to save will be independent of income and age and equal to the average propensity. Alternatively, if we postulate that consumption and income grow at the same constant rate, the marginal and average propensities will be equal and depend upon the rate of growth of income.

Under non-stationary income conditions, if we use the simple hypothesis proposed by Modigliani to express income expectations and asset-holdings as functions of current income and the elasticity of income expectations, the marginal propensity to save rises with age up to retirement unless the elasticity of income expectations is very low indeed.¹ Moreover for any age group the more inelastic are income expectations the higher will be the marginal propensity to save. The Friedman hypothesis, likewise, tells us that the marginal propensity to save will be greater, the more unstable is income over time.

When we introduce complications of changing family size our variant of the Modigliani hypothesis tells us that, other things equal, the marginal propensity to save should be higher at young and near-retirement ages than at intermediate ages.

Table 2.3 contains the cross-section marginal propensities to save by age and occupation groupings using the two alternative survey definitions of saving.

TABLE 2.3
Cross-section Marginal Propensities to Save out of Net Income

Occupation		1 (18-24)	2 (25-34)	Age 3 (35-44)	Group 4 (45-54)	5 (55-64)	6 (65 and over)	All Ages
Manual	S	.0416	-.0646	.0112 ¹	-.0013 ¹	-.1485	-.1542 ¹	-.0262
	S'	.1006	.1296	.0732	.0662	.0884	-.1489	.0792 ¹
Clerical and Sales	S	-.0422	.0867	.0673	.0821	.0104 ¹	-.0542 ¹	.0391
	S'	.0465	.1993	.1578	.1241	.0594 ¹	.0526 ¹	.1228
Managerial	S	-.1165 ¹	.1692	.2213	.3063	.1442	-.6166	.2112
	S'	.1425 ¹	.1034	.4621	.3298	.2327	.2838	.3042
Self- employed	S	—	.7141	.2340	.2362	.6039	.3867	.3594
	S'	—	.7496	.3065	.2716	.6606	.4572	.4154
Retired and Unoccupied	S	.0932	.1576	-.0438	-.4193	-.3614	-.0293	-.1541
	S'	.0971	.3151	.0040 ¹	-.2190	-.2096	+.0150 ¹	-.0615
All	S	.0173 ¹	.1541	.1476	.1591	.0825	-.0493	.1020
	S'	.0883	.2777	.2672	.2221	.1854	.1086	.2018

¹ Denotes standard error exceeds point estimate.

The employment of observations based on survey definitions for the testing of these theories is open to the same objections as those delineated in the preceding section. But the effect on the marginal coefficient is more difficult to distil since this depends upon the variances and covariances of

¹ Modigliani *op. cit.* p. 424 fn.

savings and income. One would surmise that the desired adjustments to survey estimates would tend to raise the covariance¹ and also the simple correlation coefficient, at least where S is the dependent variable. One might go further and suggest that the dispersion of savings might be reduced relatively to that of income. But in the absence of any adequate signposts these are matters of opinion. If, however, the dominant effect is one in which the correlation coefficient is raised, the marginal propensities enumerated in Table 2.3 will be underestimates of the cross-section marginal propensities we wish to measure. In the circumstances the best course to adopt would appear to be adherence to across age-group comparisons for each definition of savings separately.

The marginal propensity to save (S) for Manual is positive in group 1, becomes negative in group 2, rises again and falls sharply at age 55. The value with savings plus durables (S') as dependent variable dips in groups 3 and 4. Manual workers lend some support to the family size aspect of the hypothesis at least. Clerical and Sales run contrariwise, the highest values of the marginal propensity to save occurring in the middle age groups. The marginal propensities to save for Managers are also higher in the middle groups whereas the Self-employed show closer affinity in relative movement to Manual. One group, Manual, therefore supports, two apparently flatly contradict, this aspect of the hypothesis. There is little evidence of a rising trend with age in the marginal propensities, except for Managers.

Table 2.4 sets out the cross-section marginal rates of durable consumption with respect to income. Manual has two peaks, one in age-group 2 the other in group 5, Clerical and Sales reach a peak in age group 2, Managers

TABLE 2.4

Cross-section Marginal Rates of Durable Consumption with respect to Net Income

<i>Occupation</i>	<i>1</i> (18-24)	<i>2</i> (25-34)	<i>Age</i> <i>3</i> (35-44)	<i>Group</i> <i>4</i> (45-54)	<i>5</i> (55-64)	<i>6</i> (65 and over)	<i>All</i> <i>Ages</i>
Manual	.0590	.1942	.0620	.0675	.2369	.0053	.1054
Clerical and Sales	.0887	.1126	.0905	.0420	.0490	.1068	.0837
Managerial	.2590	-.0658	.2408	.0235	.0885	.9004	.0930
Self-employed	—	.0355	.0725	.0354	.0567	.0705	.0560
Retired and Unoccupied	.0039	.1575	.0478	.2003	.1518	.0443	.0926
All	.0710	.1236	.1196	.0630	.1029	.1579	.0998

in group 1 and again in 3, Self-employed in group 3. In each case a peak either precedes by one age-group or coincides with that in which the corresponding cross-section average propensity is a maximum. The fact that, as a general rule, a peak marginal rate of durable consumption occurs early in the lifespan, does help to explain the quite appreciable increase in the

¹ Superannuation payments are probably closely geared to income.

marginal propensity to save net of durables in the fourth age groups of Managers and Clerical and Sales. The desire for durable goods as a form of saving has been temporarily satisfied and saving can now take other forms. But this is a temporary 'relative' saturation since the marginal cross-section rates of durable consumption with respect to net income increase in age-group 5,—in the case of Manual quite appreciably.

The low value of the mean liquid asset/income ratio relative to the average over the working life or to the trend for Managers in group 3 would suggest that marginal propensities to save would then be high. This may help to account for the absence of a dip in this group.

A comparison of marginal propensities across occupation categories within an age group lends support to the income variability aspect of the hypotheses. The propensities are, as a general rule, appreciably higher for Managers and Self-employed than for other groups, the latter having on balance, the highest values. The very considerable marginal propensities to save of the Self-employed in age-groups 2 and 5 would seem to be adequately accounted for by the Friedman hypothesis. At young ages entrepreneurs will be motivated to plough back profits not only because of uncertain income expectations but also because in the longer run they think that their business activities will prove more profitable outlets for funds than investment outside. Ploughing back in the 55—65 age bracket may be a means of offsetting reduced adaptability with age. We attribute the dip in age group 4 principally to the very large liquid asset-income ratio.

But for Managers most of these arguments do not apply. The marginal propensities in age groups 3 and 4 are very large, but we cannot feel very satisfied with the explanation provided by the income variability aspect of the hypothesis. Nor should we have thought that the other factors adduced provide an altogether adequate explanation of our results.

In summary, we can say that there is some measure of support for the income variability hypothesis though the evidence is contradictory about the influence of age and family size.

The relationship between the average and marginal propensities to save out of net income

Friedman's hypothesis is specific on this interrelation. If we can choose a cross-section of households in such a way that it is plausible to assume that the mean transitory income and consumption of the group is zero, the average propensity to consume is k and the marginal propensity to consume kP_Y . The latter divided by the former gives P_Y , the ratio of the variance of permanent component of income to that of total income. We have seen that this ratio may affect the value of k itself but since k enters into both propensities this does not cause any trouble. We stress again that the definitions of income and consumption appropriate to this analysis differ from the observed incomes and consumption on survey definitions. We have two definitions of consumption (saving) and calculate an estimate of P_Y

TABLE 2.5
Cross-section Average Propensities to Consume out of Net Income (k)
Estimates of Proportion of Variance of Measured Income Contributed by Permanent Component (P_v)
Mean Number in Family in Age Cell (J_A)

Occupation		Age Group						All Ages
		1 (18-24)	2 (25-34)	3 (35-44)	4 (45-54)	5 (55-64)	6 (65 and over)	
Manual ...	k	(a) .99 (b) .95	(a) 1.01 (b) .93	(a) .99 (b) .95	(a) 1.00 (b) .96	(a) .97 (b) .96	(a) 1.10 (b) 1.06	(a) 1.00 (b) .95
	P_v	.97	1.05	1.00	1.00	1.12	1.06	1.00
	J_A	1.28	3.03	3.74	2.88	2.02	1.82	2.77
Clerical and Sales ...	k	.99	1.02	1.05	.98	.99	.96	1.01
	P_v	1.05	.90	.89	.94	1.00	1.10	.96
	J_A	1.21	2.32	2.91	2.34	2.01	1.67	2.08
Managers ...	k	1.04	1.02	.95	.94	.95	1.27	.97
	P_v	1.08	.82	.82	.74	.90	1.28	.81
	J_A	1.06	2.26	3.41	2.28	1.84	2.10	2.53
Self-employed ...	k	.89	.80	.79	.99	.70	.87	.84
	P_v	—	.36	.34	.77	.57	.71	.76
	J_A	1.00	3.25	3.05	2.91	2.08	1.90	2.82

Note. The overall mean family size estimate is only appropriate if we accept the assumption that those who are still employed after age 65 have the same size families as those who have retired.

(a) Consumption expenditures including durables.

(b) Consumption expenditures excluding durables.

from each. These are given in Table 2.5 for each of the age and occupation categories we have selected. For these categories the assumption that the mean transitory components are zero seems reasonable. P_Y lies between 0 and 1. There are two reasons (other than the possible invalidity of the hypothesis) why our estimates may lie outside these limits. The first is the disparity between theoretical and survey definitions of the variables, the second is attributable to sampling fluctuations.

A cursory examination of the table shows that P_Y tends to decrease as we move from Manual to Clerical and Sales, and thence to Managers and Self-employed groups.

For Manual workers there is little variation in P_Y across age groups. Clerical & Sales and Managers reveal a dip in P_Y in age groups 2 to 4 while the Self-employed estimates fluctuate a good deal. The low value of P_Y in age-group 2 for Self-employed is to be expected at a stage when these people are faced by the uncertainties and trials of opening up and developing new businesses. Low values for Self-employed in age groups 5 and 6 probably indicate, as we have said, declining adaptability in the face of new competition. At intermediate ages P_Y is quite large reaching a peak in age-group 3 when its value differs little from that of Manual workers.

The low values of P_Y for Clerical & Sales and Managers in age-groups 2 to 4 point to income variability as an important cause of the high marginal propensities to save already observed. Rapid promotion after individuals have shown their mettle or the effects of job transference may be operative factors here, but one would have thought that this explanation could apply to group 2, possibly to group 3, but not to 4 when, for Managers, P_Y falls to approximately 0.75, so that it is difficult to believe that income variability is the important influence.

Independent evidence from a scrutiny of income data is necessary to justify these conclusions. We cannot test the hypothesis from our present body of material on this issue. But the hypothesis does have the merit of indicating what evidence we should look for if we wish to reconcile the apparently inconsistent behaviour in these age and occupation groups with the theory of saving. In relation to our present study it suggests that rejection of the theory because of these observed deviations would be premature.

The analysis has so far been based on the comparison of mean savings and mean incomes for age and occupation groups or least-squares estimates derived from a simple linear relationship in which net income is the sole independent variable. In the following sections we shall complicate the statistical analysis by introducing other explanatory variables explicitly.

The explicit introduction of an assets term in the savings function

In the Modigliani hypothesis if we consider a cross-section of households satisfying 'the stationary' conditions the savings function may be written

$$S_t = \frac{M}{L_t} Y_t - \frac{1}{L_t} a_t. \quad (2.31)$$

The coefficient of the asset term is negative and $-\frac{1}{M}$ times the income coefficient in magnitude at any age within the earning span. For a regularly progressive state where consumption is assumed to grow at the same rate as income (g) the ratio of the income to the asset coefficient is

$$-\frac{(1+g)^{N+1-\tau}[(1+g)^{L-N}-1]}{g}. \quad (2.32)$$

In both cases the coefficient of the asset term decreases, while that of the income term increases, with advancing age. For non-stationary conditions, if we adopt the Modigliani assumption for Y^e in a cross-section the asset coefficient is not affected by changes in income expectations. When the elasticity of income expectations increases, the income coefficient tends to fall.¹ Somewhat stronger conditions have to be satisfied when we allow for the complications that ensue from changes in family size, since these react on both income and asset terms.

Estimates of total assets of individuals are limited and of uncertain reliability; therefore we are forced to make what use we can of the estimates of liquid assets at the beginning of the current period, but there is little point in setting out these properties unless we can expect some simple relationship to hold as between liquid and total assets. We have indicated that there is some evidence that for Manual and Clerical & Sales groups liquid assets are an important ingredient of the assets total. Any association between assets and age will, in all probability, be most easily detected in these two occupation groups. Response to changes in income expectations elasticities may be examined across occupation divisions.

Assets serve the further function of constituting a reserve against emergencies. In the Friedman hypothesis it is this aspect which calls for the explicit introduction of assets in the consumption function. In their rôles as sources of income and as stabilizers of consumption patterns they are already embodied in the permanent component of income.

Friedman writes the relation between permanent consumption and income

$$C_P = kY_P \text{ where } k = f\left(\frac{a}{Y_P}, i, J, A\right) \quad (2.33)$$

If we choose a group of households for whom i, J, A are similar, we may write

$$C_P = f\left(\frac{a}{Y_P}\right)Y_P. \quad (2.34)$$

Variations in the asset/income ratio affect the permanent consumption/income ratio in a rather complex way. Given any desired permanent asset/income ratio, $\frac{a_P}{Y_P}$, the greater the actual asset/permanent income ratio, the

¹ These conclusions would be modified if we permitted the elasticity of income expectations to vary with age, *vide* Modigliani, *op. cit.*, p. 424.

greater will the permanent consumption/income ratio become. Given the actual asset/permanent income ratio, the greater the desired asset/income ratio, the lower will the permanent consumption/income ratio become.

If we approximate this function by a linear expression, we may write

$$\frac{C_P}{Y_P} = \beta_1 + \gamma_1 \left\{ \frac{a}{Y_P} - \frac{a_P}{Y_P} \right\}. \quad (2.35)$$

where both β_1 and γ_1 are positive, a denotes actual asset holdings, a_P those deemed appropriate.

If we replace total assets by liquid assets and assume that the same type of relationship prevails, we obtain

$$\frac{C_P}{Y_P} = \beta + \gamma \left\{ \frac{L}{Y_P} - \frac{L_P}{Y_P} \right\} \quad (2.36)$$

or

$$C_P = \beta' Y_P + \gamma L \quad (2.37)$$

where $\beta' = \beta - \gamma \frac{L_P}{Y_P}$.

We should like to obtain estimates of β' and γ from our sample. Two possible methods will be considered; one using means of variables, the other based on least-squares methods. As emphasised in preceding sections we should expect the latter to be biased.

If we can subdivide our data into groups in such a way that it is plausible to assume $\bar{C}_P = \bar{C}$; $\bar{Y}_P = \bar{Y}$, we may be able to estimate β' and γ . This is a more general case of that described on page 228. But choice of groups must be made with care. The Friedman hypothesis argues that $\frac{C_P}{Y_P}$ will tend to fall as income instability increases (lower P_Y) *via* the associated increase in the desired permanent (liquid) asset/income ratio $\frac{L_P}{Y_P}$. Moreover, there is an

hypothesis and some evidence that the (liquid) asset/income ratio increases with age. We therefore wish to distinguish groups whose members do not differ, on average, in age, family size and relative income stability. Assuming that we can isolate two such groups we would fit the observations for mean values of variables to equation 2.37. Given two equations and two unknowns, β' and γ , by ordinary simultaneous equations methods, we obtain estimates. The obvious weakness of this procedure is our assumption that the observations fit the equation *exactly*. But this is the best we can do on limited evidence as a first approximation.

The most homogeneous groups at our disposal would appear to be Manual and Clerical & Sales in age group 5.

Together these yield the following estimates :

$\beta' = .95$ $\gamma = .03$ (durables excluded from consumption)

$\beta' = .95$ $\gamma = .025$ (durables included in consumption).

Estimates for age group 1 are :

$\beta' = .94$ $\gamma = .17$ (durables excluded from consumption)

$\beta' = .99$ $\gamma = .03$ (durables included in consumption).

A somewhat better method would be to take the mean estimates for the variables in the same age and occupation categories in two separate years. Such information is not at present available in group form. The best we have are results for two years for given age groups but covering all occupation groups. Differences in the definitions of variables between the two years seem quite sufficient to destroy any usefulness in the results.¹

We turn now to our second method. Suppose we can choose a set of households of similar age and family structure whom we assume to desire similar ratios of liquid assets to permanent income so that the following relation between permanent components adequately depicts behaviour patterns

$$\begin{aligned} \frac{C_P}{Y_P} &= \left\{ \beta - \gamma \frac{L_P}{Y_P} \right\} + \gamma \frac{L}{Y_P} \\ &= \beta' + \gamma \frac{L}{Y_P} \end{aligned} \quad (2.38)$$

We wish to enquire whether the coefficients of a least-squares linear relationship between measured consumption, income and liquid assets provide information upon β' and γ .

We follow Friedman's method of separating out permanent and transitory components of income and consumption but make no such subdivision for liquid assets. We add one further assumption to those given earlier, *viz.*, transitory components of consumption are distributed independently of liquid assets.

It may be shown that the estimates of b and c in

$$C = a + bY + cL \quad (2.39)$$

$$\text{are} \quad b = \beta' - \beta' \left\{ \frac{\text{var}_L \text{var}_{Y_T} (1 - r_{LY_T}^2) - \text{cov}_{LY_T} \text{cov}_{LY_T}}{\text{var}_L \text{var}_{Y_T} (1 - r_{YL}^2)} \right\} \quad (2.40)$$

$$\text{and} \quad c = \gamma - \gamma \left\{ \frac{\text{cov}_{LY_T} \text{var}_{Y_T} - \text{cov}_{LY_T} \text{var}_{Y_T}}{\text{var}_L \text{var}_{Y_T} (1 - r_{YL}^2)} \right\}. \quad (2.41)$$

where $\text{var}_Y = \frac{\Sigma(Y - \bar{Y})^2}{n}$ etc., as given by the n observations in the sample.

It is apparent that b and c will in general provide biased estimates of β' and γ but it is not possible to say, *a priori*, whether the bias will be downward or upward. If the variance of transitory incomes is zero, $c = \gamma$, $b = \beta'$;

¹ For the benefit of those who may wish to see them (though we count them as of very low reliability) they are listed here. Consumption includes durable goods expenditure.

Age Group

	1	2	3	4	5
β'	1.12	.77	.70	1.08	.92
γ	-1.91	+ .70	+ .82	+ .23	+ .00

The values of γ appear excessive in the younger age groups.

if the variance of permanent incomes is zero, c provides an unbiased estimate of γ , and $b = 0$.

Since our survey information relates to savings, not consumption, our estimates of b and c come indirectly from least squares equations in savings.

Table 2.7 enumerates the least-squares estimates of the savings functions :

$$S = a' + b'Y + c'L \text{ and } S' = a' + b'Y + c'L$$

For certain groups we are in a position to compare the implied estimates of $1-b'$ and $-c'$ with those already given for β' and γ

TABLE 2.6
Manual and Clerical and Sales Groups
Estimated Consumption Coefficients

Occupation	Coefficients	Age Group 18-24		Age Group 55-64	
		Dependent C	variable C + DC	Dependent C	variable C + DC
Manual and Clerical & Sales	β'	.94	.99	.95	.95
Manual	$1-b'$	.90	.96	.92	1.13
Clerical & Sales	$1-b'$	.96	1.03	.95	.99
Manual and Clerical & Sales	γ	.17	.03	.03	.03
Manual	$-c'$	-.00*	.04*	-.01*	.04
Clerical & Sales	$-c'$	-.02*	.04*	-.00*	.00*

Even if we are bold enough to accept our direct estimates of β' and γ (from pages 242-3 above) at their face value, it would seem that we cannot obtain any clear guide quantitatively to the direction of bias in b and c .

We pass to more general comments on Table 2.7.

TABLE 2.7
Regression Coefficients for Savings Functions

Age Group	Manual		Clerical & Sales		Managers		Self-employed	
	Y	L	Y	L	Y	L	Y	L
$S = a + bY + cL$								
18-24 ...	+.037	-.043*	-.036*	-.035	+.017*	-.565		
25-34 ...	-.054	-.046	+.136	-.201	+.191	-.042*	+.711	-.076
35-44 ...	+.012*	-.060	+.169	-.246	+.234	-.025*	+.234	-.002*
45-54 ...	+.038*	-.061	+.077	+.025*	+.312	-.008*	+.234	-.016*
55-64 ...	-.131	-.035	+.012*	-.002*	+.097	+.031	+.605	-.003*
65 and over ...	-.121*	-.094	-.016*	-.028*	-.685	+.065*	+.401	-.030*
$S' = a + bY + cL$								
18-24 ...	+.100	+.002*	+.043	+.021*	+.118*	+.104		
25-34 ...	+.112	+.074	+.210*	-.043*	+.086	+.033*	+.748	-.046
35-44 ...	+.073	+.010*	+.140	+.060*	+.462	+.000*	+.311	-.016*
45-54 ...	+.065	+.002*	+.110	+.077	+.349	-.027*	+.271	-.003*
55-64 ...	+.083	+.011*	+.052*	+.009*	+.211	+.014*	+.663	-.011*
65 and over ...	-.126*	-.066	+.008*	+.032*	+.357	-.070	+.475	-.037

In the equations with S as dependent variable, the coefficient of L is negative (when significant) except for Managers in the 55—64 age bracket; while for the equations with S' as dependent variable, it is positive with the exception of the 25—34 self employed group. In nearly all equations pertaining to Managers and Self-Employed the coefficient of L is not significantly different from zero. There are, as it happens, few exceptions to this in equations in S' . The income coefficient is positive for all S' groups and significantly negative in only two groups in S : Manual 25—34 and 55—64.

In the interpretation of the role of assets, the hypotheses of Modigliani and Friedman diverge and we turn to examine the extent to which the Modigliani propositions are supported by the data. We note, first, support for a common feature of the two hypotheses—the tendency for the income coefficients to be greater in the more variable income groups. Liquid assets coefficients reveal no systematic variation across occupation divisions and this would seem to support the Modigliani hypothesis. But the sign of L often differs from that expected from the theory. Nor is there very much evidence of a systematic age effect, although both the Y and L coefficients for Managers in the S equations tend to increase with age—but only up to age 54 in the case of the Y coefficients. In the S' equations, the Y coefficients for Clerical & Sales fall after the second age group while the L coefficients for Managers tend to decrease with age from the third age group. There is also no common systematic relationship to be observed between the Y and the L coefficients, although such a relationship may be obscured by changes in family size. In the S equations both the Y and the L coefficients for Managers tend, as we have seen, to increase with age, but they tend to move in opposite directions for Clerical & Sales, at least over age groups 1 to 4. In the S' equations, the Y and L coefficients for Manual groups tend to increase and decrease together over the life span.

Once again the theoretical expectations about the influence of age are not clearly discerned.

There are two instances where the income coefficients diverge significantly from previous results. These are the estimates in the S equations for Clerical & Sales, 25—34 and 35—44. In these the addition of L greatly improves the fit and raises the coefficients of income. The coefficient of L is appreciable.¹ In these age groups the desire to accumulate durables is most intense and the large coefficients of L may reflect the greater preference at this stage for tangible assets as opposed to intangible. A similar explanation might account for the large L coefficients in Managers, 18—24.

Explicit allowance for variations in family size

The modifications introduced in the Modigliani hypothesis to cope with variations in family size suggest that the relevant variables are Y , $\bar{Y}$, JY , J , A , $\bar{J}A$, JA , etc. It is obvious that all these variables cannot be introduced simultaneously into an empirical equation. The analysis becomes less

¹ In this paragraph, when we describe a coefficient as large, we neglect considerations of sign.

intractable when we classify our data into age groups, but even then we are unable to include both Y and JY without encountering serious multicollinear difficulties. As a trial procedure we elect to incorporate J , the number in the family in the current period, additively into our relationships. This variable should have a negative coefficient on this hypothesis.

The estimates are given in Table 2.8.

TABLE 2.8
Regression Coefficients for Savings Functions

Age Group	Manual		Clerical and Sales		Managers		Self-employed	
	Y	J	Y	J	Y	J	Y	J
	$S = a + bY + cJ$							
18-24	.036	2.083*	-.041	- 2.049	-.078*	-61.777*		
25-34	-.081	4.136*	.056*	+ 9.248*	.013*	+ 70.365	.667	50.555
35-44	.026*	- 3.251*	.078	- 5.100*	.223	- 1.246*	.244	- 7.684*
45-54	-.022*	+ 4.436*	.113	-19.751	.349	-44.038	.144	+ 141.496
55-64	-.075	-23.290	.105*	-28.921	.154	- 8.279*	.617	-102.892
65 and over	-.123*	-13.166*	-.020*	-13.865*	-.791	535.104	.392	- 39.410
	$S' = a + bY + cJ$							
18-24	.091	3.817*	.048	- 2.176*	.167	-37.980		
25-34	.159	- 7.633	.224	- 7.661*	.026*	35.009	.717	34.793
35-44	.095	- 4.960	.176	- 8.113*	.509	-33.732	.375	-52.196
45-54	.073	- 1.444*	.161	-23.614	.378	-49.676	.295	-35.468
55-64	.131	-13.656	.153	-28.378	.255	-18.599*	.671	-83.759
65 and over	-.131*	- 7.589*	.078*	-10.016*	.286	- 6.998*	.463	-42.927

With S as dependent variable J has a negative coefficient (when statistically significant) in age groups other than 25-34 Managers and Self-employed and 45-54 Self-employed. With S' as dependent variable the sign is again negative except for the 25-34 age groups in the same occupations.

The explanation of the positive coefficients of J in the 25-34 age groups is not difficult. We have hitherto neglected the fact that mean expected lifetime family size is not independent of current family size. Since the family size variables always occur in the form $\bar{J} - J$ the sign of $\frac{\partial S}{\partial J}$ depends on $\frac{\partial \bar{J}}{\partial J}$. In general, we should expect the latter to be less than unity save at young ages when it is possible, in the 'marriage' age groups at least, that it may exceed unity. If $\frac{\partial \bar{J}}{\partial J}$ is greater than one, the coefficient of J will be positive.

For the self-employed group, aged 45-54, we find a strong positive marginal response of durable consumption expenditure to any decline in family size. The value of P_Y would suggest that this age-group is enjoying a higher degree of income stability than is usual for the Self-employed and because of an excessively high reserve of assets they are tending to consume

more. Any fall in the size of the family under these circumstances would probably accentuate the desire for further durable consumption.

Comparing the results in Tables 2.8 with the estimates in Table 2.3, we find that there is little tendency for the income coefficients in the S equations to change with the addition of the variable, J , except for Clerical & Sales, but slight increments occur in the S' equations. The form in which family size has been included in our equations has not removed the peaks in the income coefficients previously attributed to this factor; if anything it sharpens them.

Tables 2.9 provide the estimates when we include Y , L and J simultaneously. Little change takes place in the coefficients of either L or J . But the standard errors of the coefficients of L in the S' equations generally exceed the point estimates. On the basis of a rule devised by J. Durbin, better estimates of the remainder can be obtained by its deletion. This argument applies also to the S equations relating to the Self-employed.

The interpretation of certain results in Part I on the Friedman Hypothesis

In Part I we subdivided the non-entrepreneurial portion of our sample into measured income groups, and estimated various interrelations between savings, liquid assets, age and family size for each group. Liquid assets proved to be the only significant variable. We wish to ascertain whether these estimates reveal the influence of liquid assets, *per se*, on Friedman's hypothesis.

The subdivision of a sample into groups of constant measured income does not ensure that permanent income is kept constant. Quite the contrary is true. Within an income class there will be some earning incomes higher than those they regard as permanent, while for others current incomes will be lower than levels regarded as permanent. However, in the highest and lowest reaches of the current income distribution we may expect to find a preponderance of those whose permanent incomes are lower and higher respectively than the levels received currently. Moreover, to the extent that income groups contain people whose measured incomes are closely aligned to their permanent incomes, we should expect the influence of liquid assets on savings behaviour for these people to be negligible because of the high degree of income stability enjoyed.

Our analysis is simplified insofar as the self-employed are excluded from our sample but is complicated by the retention of the retired and unoccupied. If, however, we ignore the two lowest income groups we largely dispose of this problem. Moreover, the Managerial group are likely to be those mainly responsible for relatively large transitory variations in income in our sample.

Consider a group of individuals who adhere to the same permanent component relationship

$$C_P = \beta Y_P + \gamma(L - L_P), \quad \gamma \geq 0, \quad (2.43)$$

and currently receive the same measured income. We fit by least squares the

TABLE 2.9

$$\text{Equation } S = a + bY + cL + dJ$$

Age Group	Manual			Clerical and Sales			Managers			Self-employed		
	Y	L	J	Y	L	J	Y	L	J	Y	L	J
18-24	+.042	-.044*	+ 2.193*	-.035*	-.031*	- 1.481*	+.002*	-.576	+ 28.131*	+.670	-.054*	+ 45.453
25-34	... -.064	-.042	+ 2.533*	+.118	-.192	+ 5.077*	+.032*	-.056	74.978	+.244	-.001*	- 7.639*
35-44	... +.035*	-.069	- 5.110	+.224	-.397	- 18.245	+.237	-.026*	2.352*	+.144	+.004*	+ 141.693
45-54	... +.036*	-.060	+ .501*	+.108	+.023*	- 19.111	+.360	-.013*	- 45.361	+.607	+.043*	- 113.641
55-64	... -.044*	-.043	- 26.092	+.119*	-.012*	- 29.808	+.095	+.031	.701*	+.400	-.018*	- 34.354
65 and over	-.077*	-.095	- 18.519*	+.164*	-.069	- 49.381	-.662	-.141*	+ 591.364			
<i>Equation S' = a + bY + cL + dJ</i>												
18-24	+.090	+.001*	+ 3.815*	+.044*	+.027*	- 2.677*	+.149*	+.127	- 57.788*	+.719	-.030*	+ 31.950
25-34	+.133	+.065	- 5.129	+.243	-.058*	- 8.915*	+.016*	+.027*	+ 32.761	+.378	-.011*	- 51.725
35-44	... +.095	+.001*	- 4.934	+.161	+.043*	- 6.747*	+.514	-.009*	- 34.136	+.294	-.008*	- 35.929
45-54	... +.072	+.001*	- 1.347*	+.144	+.074	- 21.589	+.405	-.033	- 52.969	+.665	+.026*	- 90.211
55-64	... +.127	+.006*	- 13.235	+.153*	-.000*	- 28.403	+.237	+.009*	- 15.946*	+.474	-.024*	- 36.323
65 and over	-.099*	-.066	- 11.336*	-.033*	+.041*	- 11.305*	+.358	-.078	+ 24.405*			

relation $C = cL + d$ to observations for a measured income group. The estimate of c is

$$\frac{\Sigma(C - \bar{C})(L - \bar{L})}{\Sigma(L - \bar{L})^2}. \quad (2.44)$$

By inserting (2.43) into this expression and using the assumptions on page 243 above concerning C_P and Y_P , we obtain

$$c = \gamma + \beta \frac{\Sigma(Y_P - \bar{Y}_P)(L - \bar{L})}{\Sigma(L - \bar{L})^2} - \frac{\gamma \Sigma(L_P - \bar{L}_P)(L - \bar{L})}{\Sigma(L - \bar{L})^2}. \quad (2.45)$$

The last fraction is smaller than γ . Since γ and $\Sigma(Y_P - \bar{Y}_P)(L - \bar{L})$ are assumed to be positive, c will be positive though we cannot say whether it will be greater or less than γ . In general it will be biased. Furthermore, even if the actual liquid asset/income ratio is equal to the equilibrium ratio desired, thereby eliminating any dependence of permanent consumption upon liquid assets, the least-squares estimate, c , in a given measured income group will be positive and upward biased through the cross-section interdependence between permanent income and liquid assets.

A negative coefficient of L in $S = c'L + d'$ is consistent with the Friedman hypothesis but provides no clear evidence as to the value of $-\gamma$ in the permanent component relationship. The least squares estimates of $S = c'L + d'$ for measured income classes are given in Table 1.9 of Part I. With the exception of the income class £500-£599 the coefficients of L , when significant, are consistently negative. We are unable to advance an explanation for the deviation in this one case.¹

The permanent component relationship enables us to infer the variations in $\frac{\bar{C}}{\bar{L}}$ across net income groups in a sample of households classified solely in this way. We have already remarked that at both high and low income levels there will be a preponderance of people whose income expectations are very unstable. Below the mean income group there will be a concentration of people whose current incomes are below their permanent incomes though there may be some downward revision of expectations taking place also. Above the mean income group the reverse is true. The more unstable are income expectations, the greater the desired asset/income ratio and, in general, the lower the permanent consumption/income ratio.

We write the permanent consumption relation in a more convenient form:

$$\frac{C_P}{L_P} = \beta \frac{Y_P}{L_P} + \gamma \frac{L}{L_P} - \gamma \quad (2.46)$$

Since we expect $\frac{Y_P}{L_P}$ to fall as income instability increases, $\frac{C_P}{L_P}$ will tend to fall also. The assumed independence of transitory consumption and income ensures that, other things equal, $\frac{\bar{C}}{\bar{L}_P}$ will be lower in groups with

¹ In this section we ignore the effect of age. The mean ages in net income groups examined differ but slightly.

greater income instability. But C_P is influenced by $L - \bar{L}_P$. L will probably be greater than $\bar{L}_P$ on balance in income groups above the mean and this will raise $\bar{C}$. $\bar{L}$ will probably be below $\bar{L}_P$ in income groups below the mean and this will reduce $\bar{C}$. But the intensity of this influence, γ , will be small compared with β . We may expect therefore that $\frac{\bar{C}}{\bar{L}}$ will be lower in value in high and

low income groups than in the mean income groups. The degree of income instability in very low and in very high income groups may differ appreciably. In fact, it is probable that on balance those with the greatest income instability had in 1953 experienced, on average, incomes higher than anticipated.

The observed ratios for net income groups are given in Table 2.10.

TABLE 2.10

Income Group	$\frac{\bar{C}}{\bar{L}}$	$\frac{\bar{S}}{\bar{L}}$
I	.6	-.08
II	1.2	-.08
III	2.5	-.04
IV	3.1	-.00
V	3.1	-.06
VI	2.9	+.05
VII	2.3	-.06
VIII	1.9	+.07
IX	1.3	+.11

These results correspond closely to the hypothesis despite the fact that the arguments have been tested against data for a very heterogeneous collection of age and occupation classes.

The interpretation of summary equations relating to groups with different behaviour patterns.

We may believe that households conforming to different behaviour patterns have provided the set of observations which make up a sample. If so, we may wish to determine the characteristics of some representative behaviour equation. The task is one of obtaining good estimates.

The simplest form of the Friedman hypothesis may be used to indicate the problem. Suppose m individuals conform to the behaviour pattern

$$C_{P_1} = k_1 Y_{P_1}; \quad n \text{ to } C_{P_2} = k_2 Y_{P_2}.$$

$$\text{An estimate of } k' = \frac{mk_1 + nk_2}{m+n} \text{ is sought} \quad (2.47)$$

$$\text{Since } \sum_i^m (C_{P_{1i}}) = m\bar{C}_{P_1}, \text{ etc.,}$$

$$m\bar{C}_{P_1} = mk_1 \bar{Y}_{P_1} \quad (2.48)$$

$$n\bar{C}_{P_2} = nk_2 \bar{Y}_{P_2} \quad (2.49)$$

Adding and dividing throughout by $m+n$, we obtain

$$\bar{C}_P = \frac{m\bar{C}_{P_1} + n\bar{C}_{P_2}}{m+n} = \frac{mk_1 \bar{Y}_{P_1} + nk_2 \bar{Y}_{P_2}}{m\bar{Y}_{P_1} + n\bar{Y}_{P_2}} \bar{Y}_P. \quad (2.50)$$

If the only information available is the mean permanent consumption and incomes of all the individuals (C_P , Y_P), the estimate of the mean permanent consumption/income ratio is the coefficient in (2.50) which depends upon the mean permanent incomes in each subgroup. If these are equal, an unbiased estimate of k' is obtained. Of course, direct observations are not available and means of observed variables in suitably chosen groupings might be used as estimates of mean permanent components.

Suppose that the observations available relate to two groups which differ in income variability alone. A linear relationship is fitted by least squares to the set as a whole. If the two behaviour groups could be separated the estimates of the marginal propensity to consume in each would be $k_1 P_{Y_1}$ and $k_2 P_{Y_2}$ respectively.

The estimate of b in the equation

$$C = a + bY \quad (2.51)$$

fitted to the combined groups in the special case where

$$\bar{C}_{T_1} = \bar{C}_{T_2} = \bar{Y}_{T_1} = \bar{Y}_{T_2} = 0$$

is

$$\frac{k_1 \sum^m (Y_{P_1} - \bar{Y}_{P_1})^2 + k_2 \sum^n (Y_{P_2} - \bar{Y}_{P_2})^2 + \frac{mn}{m+n} \{k_1 \bar{Y}_{P_1}^2 + k_2 \bar{Y}_{P_2}^2 - (k_1 + k_2) \bar{Y}_{P_1} \bar{Y}_{P_2}\}}{\sum^{m+n} (Y - \bar{Y})^2} \quad (2.52)$$

This obviously differs in value from the average of the marginal propensities

$$\frac{mk_1 P_{Y_1} + nk_2 P_{Y_2}}{m+n} \quad (2.53)$$

These examples are sufficient to indicate some of the difficulties that are encountered in the interpretation of data which summarize the behaviour of distinct groups. Given estimates of marginal propensities to save for subgroups, a better estimate of a representative marginal propensity to save for combined groups will be obtained by averaging, than by least-squares estimates.

Naturally enough, the more similar the behaviour patterns of the individuals in our set of data are believed to be, the easier the interpretation. Earlier results suggest that summation for any age group across Manual and Clerical & Sales groups with the possible addition of Managers would be safer than summation across any larger total of occupation groups or across age groups.

The tabulated results are more extensive than is really justified. They cover all occupational groups together; all minus self-employed; all minus retired and unoccupied; and all minus both retired and unoccupied and self-employed. Tabulations are given for each age group separately and for all age groups together: in some cases we also have estimates for all 'working' age groups together. The tabulated results are given in Appendix A to the article.

The discussion of the preceding paragraphs is premised upon the view that the structural relationships in different categories are significantly different. This is not always so. Moreover, the restricted numbers of observations in certain cells increase the possibility of extreme behaviour relative to the group influencing disproportionately the coefficients estimated for the group. For these reasons alone we should be unwilling to write off as uninteresting and uninformative results for combined groups.

Confining analysis to the results for the combined Manual, Clerical & Sales and Managers groups we observe that the income coefficient increases up to age 45—54 when S is the dependent variable, to age group 35—44 when S' is dependent.

If, on the other hand, we take the weighted average of the marginal propensities to save (S') for the individual occupation groups we obtain the following estimates for age groups 25—44. The results from the combined groups are given in the second column :—

Age group	marginal propensity to save (S')	
	weighted estimates	combined groups
25—34	.143	.179 (.039)
35—44	.131	.242 (.017)

The estimates from combined groups reveal a peak marginal propensity to save in the 35—44 age groups; whereas the weighted estimates suggest 25—34. These results emphasize the possible extent of bias and the misleading nature of estimates from combined groups when there is more than one underlying behaviour equation.

The negative coefficient for J in the combined groups equation for age group 25—34 with S' as dependent variable calls for comment. For Managers the coefficient is positive, for Manual Workers it is negative and the latter dominate in the combined group. Earlier marriage in Manual than in Managerial groups would seem to account for this inter-group difference in sign.

The fit of the S equations for the combined groups is generally poor though much improved by the addition of L or J . The quality of fit in the S' equations is much better.

The arguments advanced in this section drive home the difficulties of interpreting the coefficients in the overall equations in Part I.

A word might be added as to the efficiency of the estimates. In Part I we discovered a marked degree of heteroscedasticity which appeared to be adequately corrected for by dividing all terms in the relationship by income. To get an impression of the degree of heteroscedasticity present in the summary equations of this section we have estimated the standard deviation of residuals when equations $S = a + bY + cL + dJ$ and $S' = a + bY + cL + dJ$ are fitted to the observations in each cell. These estimates are entered in Table 2.11.

TABLE 2.11
Standard Deviations of Residuals in Savings Equations
 $S = a + bY + cL + dJ$ and $S' = a + bY + cL + dJ$

Age Group		Manual	Clerical and Sales	Managers	Self- employed	Retired	All occu- pations
18—24	S	24.74	26.21	151.13	—	7.69	29.84
	S'	28.73	22.66	52.98	—	14.64	26.66
25—34	S	79.36	127.22	139.60	157.82	58.32	112.25
	S'	57.86	99.00	133.39	144.09	44.91	90.94
35—44	S	67.78	105.68	163.23	189.46	14.25	105.14
	S'	46.72	112.34	152.57	178.63	6.89	94.66
45—54	S	75.09	65.26	202.25	142.22	109.79	119.54
	S'	69.90	59.40	153.00	184.41	79.20	97.93
55—64	S	56.27	84.56	62.48	202.11	81.50	88.48
	S'	47.47	85.81	150.87	199.30	75.58	85.32
65 and over	S	145.91	47.15	299.27	114.98	46.39	86.97
	S'	116.00	70.36	54.32	110.31	46.65	68.53
All	S	73.64	92.93	185.06	196.65	61.25	99.95
	S'	59.70	79.21	152.11	178.57	56.41	84.89

We observe a prevalent tendency for the standard deviation to increase as income variability (across occupations) increases. Despite the fact that mean incomes in occupation groups are almost always less for any age group in the Self-employed class than in the Managers group, the standard deviation of residuals in the former is almost invariably greater. Across pre-retirement age groups the standard deviations rise to a peak and then fall and there is no clear tendency for the peak to coincide with the highest mean income, sometimes lagging, other times leading this stage. The results suggest that we have been justified in not applying the methods of correction for heteroscedasticity adopted in Part I. If correction is desired, it is probably wiser to make adjustments after estimation. The standard deviation of residuals is but imperceptibly affected by the deletion of the variables L and J from the equations.

Hitherto we have said very little about aggregation across age groups. The importance of age as an influence on savings patterns is emphasised by Modigliani who shows that, in his hypothesis, it enters as a multiple of income and asset terms. We experiment with the following equations:—

$$S(S') = a + bAY \quad (2.54)$$

$$S(S') = a + bAY + cAL \quad (2.55)$$

$$S(S') = a + bAY + cAL + dJ \quad (2.56)$$

$$S(S') = a + bAY + cAL + dAJ \quad (2.57)$$

Estimates for various combinations of occupation groups appear in Tables 2.12. They have been derived in the following manner. Given the

TABLE 2.12

Regression Coefficient for Savings Functions

	$\begin{aligned} (1) S &= a + bAY \\ (2) S &= a + bAY + cAL \\ (3) S &= a + bAY + cAL + dJ \\ (4) S &= a + bAY + cAL + dAJ \end{aligned}$					R^2
	<i>Constant</i>	<i>AY</i>	<i>AL</i>	<i>J</i>	<i>AJ</i>	
All Groups	-26.8052	+.00167 (.00020)				.03511
	-28.3503	+.00218 (.00023)	-.00075 (.00011)			.06338
	-25.1795	+.00228 (.00022)	-.00078 (.00010)	-1.9832 (1.6794)		.06402
	-18.7859	+.00262 (.00026)	-.00080 (.00011)		-.1561 (.1789)	.06980
All Groups except Self-employed	-15.0080	+.00075 (.00020)				.00816
	-16.9088	+.00125 (.00021)	-.00069 (.00010)			.03703
	-13.7132	+.00137 (.00023)	-.00072 (.00010)	-2.1293 (1.8272)		.03797
	- 9.6167	+.00165 (.00019)	-.00074 (.00010)		-.1287 (.0449)	.04251
All Groups except Retired and Unoccupied	-29.2459	+.00191 (.00023)				.04312
	-35.8872	+.00278 (.00025)	-.00119 (.00015)			.08737
	-29.4936	+.00293 (.00026)	-.00124 (.00015)	-3.3543 (2.2625)		.08915
	-24.2324	+.00338 (.00028)	-.00128 (.00015)		-.2023 (.0543)	.09798*
All Groups except Self-employed and Retired and Unoccupied	-15.3672	+.00093 (.00023)				.01176
	-23.3772	+.00185 (.00026)	-.00120 (.00015)			.06236
	-15.6596	+.00209 (.00027)	-.00128 (.00015)	-4.3334 (2.0781)		.06623
	-13.7707	+.00252 (.00030)	-.00133 (.00015)		-.1913 (.0509)	.07440*
All Groups except Self-employed and Retired and Unoccupied to- gether with all those over 65 years	-24.7259	+.00161 (.00023)				.03719
	-31.1920	+.00236 (.00025)	-.00106 (.00015)			.07432
	-20.3182	+.00274 (.00027)	-.00178 (.00016)	-6.3068 (1.9771)		.08354
	-20.5028	+.00318 (.00029)	-.00123 (.00016)		-.2248 (.0582)	.09318
All Groups except Retired and Unoccupied together with all those over 65 years of age	-35.9534	+.00245 (.00023)				.07001
	-41.5080	+.00318 (.00025)	-.00108 (.00016)			.10327
	-32.1850	+.00345 (.00027)	-.00116 (.00016)	-5.0977 (2.1927)		.10773
	-29.5695	+.00390 (.00028)	-.00121 (.00016)		-.2230 (.0530)	.11729

TABLE 2.12 (continued)

	$(1) S' = a + bAY$ $(2) S' = a + bAY + cAL$ $(3) S' = a + bAY + cAL + dJ$ $(4) S' = a + bAY + cAL + dAJ$					
	Constant	AY	AL	J	AJ	R ²
All Groups	-34.5735 (.00018)	+.00337 (.00018)				.15803
	-35.7606 (.00020)	+.00377 (.00020)	-.00058 (.00010)			.17641
	-27.5320 (.00020)	+.00404 (.00020)	-.00064 (.00009)	-5.1482 (1.4973)		.18120
	-12.7253 (.00023)	+.00482 (.00023)	-.00068 (.00010)		-.3759 (.1564)	.21743
All Groups except Self-employed	-24.5090 (.00018)	+.00257 (.00018)				.11011
	-25.9206 (.00019)	+.00294 (.00019)	-.00051 (.00009)			.12854
	-20.5486 (.00020)	+.00315 (.00020)	-.00057 (.00009)	-3.5788 (1.6137)		.13163
	- 8.6252 (.00016)	+.00389 (.00016)	-.00062 (.00009)		-.3051 (.0390)	.16418
All Groups except Retired and Unoccupied	-34.0363 (.00020)	+.00356 (.00020)				.16801
	-36.6355 (.00022)	+.00390 (.00022)	-.00047 (.00013)			.17560
	-24.1439 (.00023)	+.00420 (.00023)	-.00056 (.00013)	-6.5506 (2.0233)		.18318
	-13.3390 (.00024)	+.00510 (.00024)	-.00066 (.00013)		-.4044 (.0476)	.22312
All Groups except Self-employed and Retired and Unoccupied	-22.1541 (.00020)	+.00270 (.00020)				.11849
	-24.3586 (.00023)	+.00296 (.00023)	-.00033 (.00013)			.12304
	-15.5097 (.00024)	+.00322 (.00024)	-.00042 (.00014)	-4.9681 (1.8412)		.12907
	- 7.9012 (.00026)	+.00409 (.00026)	-.00055 (.00013)		-.3278 (.0444)	.16502
All Groups except Self-employed and Retired and Unoccupied to- gether with all those over 65 years of age	-26.7197 (.00020)	+.00314 (.00020)				.15492
	-27.4734 (.00023)	+.00322 (.00023)	-.00012 (.00014)			.15548
	-16.0378 (.00027)	+.00362 (.00027)	-.00025 (.00016)	-6.6322 (1.9767)		.16668
	-11.6813 (.00026)	+.00444 (.00026)	-.00038 (.00014)		-.3322 (.0432)	.20073
All Groups except Retired and Unoccupied together with all those over 65 years of age	-37.1138 (.00021)	+.00393 (.00021)				.19191
	-38.5503 (.00023)	+.00412 (.00023)	-.00028 (.00014)			.19428
	-23.4453 (.00024)	+.00455 (.00024)	-.00041 (.00014)	-8.2587 (2.0025)		.20676
	-16.7575 (.00025)	+.00543 (.00025)	-.00052 (.00014)		-.4071 (.0475)	.24407

cross-products of S , Y , L and J for each age-group and the mean age for each group, the cross products were weighted by the mean age or its square. The adjusted cross-products were inserted in the normal equations.

The quality of fit is better in the relationships of type 2.57 in which the explanatory variables are AY , AL and AJ than in 2.56. When the Self-employed are excluded, the best fits occur in the group which covers Manual, Clerical & Sales and Managers up to 65 years of age.

For the first four summary groups listed, we have corresponding estimates for straight linear equations in Y , L and J . In only the two cases asterisked does the employment of age as a multiple bring an improved fit. On this criterion, the case for including age in this manner is scarcely established.

The Life Cycle

Mean consumption and income levels for various age groups are given in Table 2.13. When these means are graphed against age, a parabola of the shape depicted seems to give a good fit. This suggests that the incomes

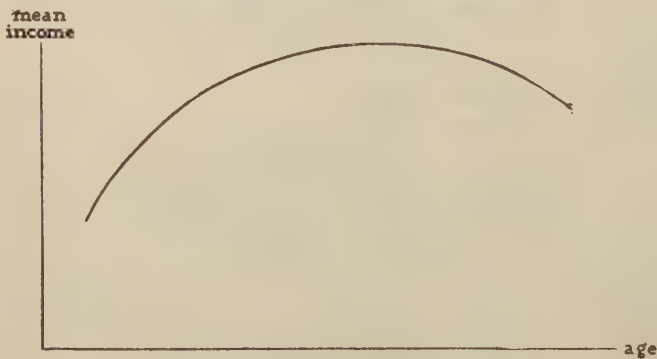


fig. 2.3

of individuals increase up to a certain age and then decline before retirement date. But the mean incomes drawn from a cross-section survey at a single point of time do not indicate directly the movements in real income of an individual or rather, that of a group of individuals, over time.

In the United Kingdom real income has been growing at a mean rate in the vicinity of one to two per cent per year. This being the case, those now in the age group 55—64 would ten years ago have been earning on average $\frac{1}{(1.02)^{10}}$ times the mean real income recorded by those currently in the 45—54 age bracket. Again, men between 15 and 24 years of age to-day will, if income trends are sustained, expect in thirty years' time to receive incomes on average approximately $(1.02)^{30}$ times the average real income currently earned by those aged 45—54.¹ If we are to use survey information

¹ This argument refers to the members of an occupation group and assumes income to grow at 2 per cent per year.

to shed light on the time patterns of income and consumption throughout the earning span of those now in the youngest age group, we must adjust the data for the prospective rate of income change..

TABLE 2.13

Lifetime Average Real Consumption and Income Levels for Certain Age and Occupation Groupings

Age Group	Manual		Clerical & Sales		Managers		Self-employed	
	Observed	Calculated A B	Observed	Calculated A B	Observed	Calculated A B	Observed	Calculated A B
<i>Consumption excluding durable goods expenditures (£)</i>								
18—24 ...	263	263 263	185	185 185	250	250 250	—	—
25—34 ...	400	488 464	401	483 465	488	595 566	416	507 507
35—44 ...	442	658 597	432	645 583	711	1059 960	485	722 563
45—54 ...	413	748 644	450	810 702	727	1316 1134	494	894 662
55—64 ...	335	740 606	388	857 702	617	1363 1116	473	1045 856
65 and over ...	373	1002 783	288	775 607	748	2012 1570	429	1154 901
<i>Income (£)</i>								
18—24 ...	276	276 276	191	191 191	274	274 274	—	—
25—34 ...	432	527 501	424	517 492	600	732 696	560	683 650
35—44 ...	466	694 629	445	663 601	834	1242 1126	659	982 890
45—54 ...	429	776 669	482	872 751	836	1523 1304	554	1003 864
55—64 ...	349	771 632	400	884 724	688	1520 1245	705	1558 1276
65 and over ...	351	944 737	309	831 649	799	2152 1678	527	1417 1107

A accumulation factor 2 per cent.

B accumulation factor $1\frac{1}{2}$ per cent.

Columns in Table 2.13 depict the effect of multiplying the observed means of income and consumption by accumulation factors based upon two alternative rates of growth, 2 per cent and $1\frac{1}{2}$ per cent. Adjustment for 2 per cent growth rates serves to remove the decline in consumption and income in the fifth age brackets whereas $1\frac{1}{2}$ per cent growth rates reduce the downward curvature of the parabola at higher ages.

A reasonable case may be made for discarding assumption VI of the Modigliani hypothesis and replacing it by one which assumes that consumption increases through time at the same rate as income. In the formula given earlier a constant rate was assumed. An alternative that might provide a better fit to the data is to assume a rate that declines through time, such as, is quoted by:

$$1 + g_t = (1 - k)(1 + g_{t-1}), \quad k < 1 \quad (2.58)$$

If initial assets are zero and expectations are continuously fulfilled the cross-section consumption function prior to retirement (assuming planning at age one) may be written

$$C = \frac{\sum_{t=1}^N \left\{ (1-k)^{\frac{t-2}{2}} (1+g_1) \right\}^{t-1}}{\sum_{t=1}^N \left\{ (1-k)^{\frac{t-2}{2}} (1+g_1) \right\}^{t-1}} Y. \quad (2.59)$$

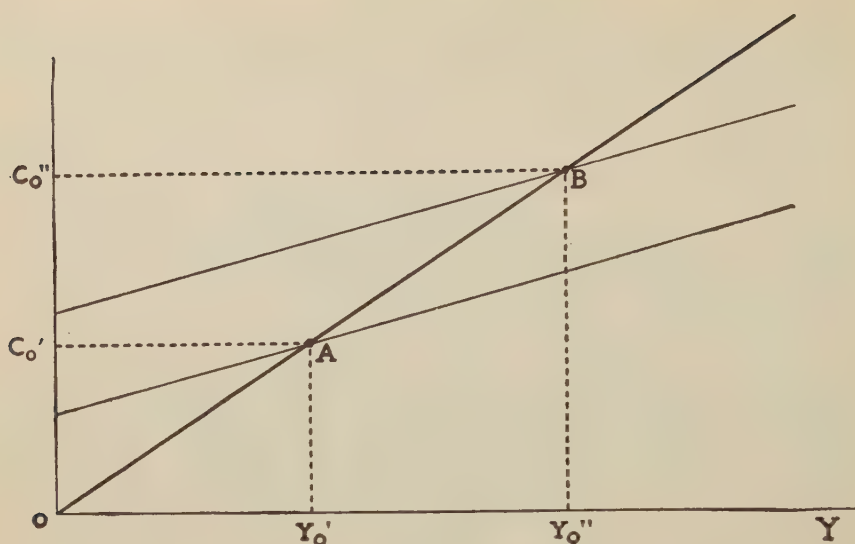


fig 2.4

In the graph the line through the origin depicts this consumption function whose slope depends upon k and g . Y_0' and C_0' represent the mean income and consumption of those now in the youngest age group, Y_0'' and C_0'' the mean income and consumption of those who will be in that age bracket in ten years' time. If the rates of growth of the variables within an age bracket remain invariant no matter at what calendar date people are within that bracket, the average cross-section propensity to consume for any given age-group under these assumptions remains constant through time.

For the prediction of mean cross-section real consumption in a given age-group adjustments must be made to survey estimates. If, for example, we assume income and consumption to grow at constant rates of 2 per cent per year and we wish to ascertain mean real consumption in an age-group ten years from now we multiply the survey recorded income by $(1.02)^{10}$ before multiplication by the cross-section propensity to save.

Within any age group the regression line of current consumption upon current income will tend to be flatter than OB (Fig. 2.4) but should pass through A, the mean income and consumption point. For those in the age bracket ten years later, if k and g and the elasticity of income expectations remain unchanged, the slope will remain the same but the regression line will be shifted upwards and pass through B. The intercept of the regression line of consumption (savings) upon income is greater positively (negatively) for those entering an age bracket some time hence than for those now in it.

If, then, a least-squares equation $S = a + bY$, is fitted to the observations of an age-group, the coefficient of Y will remain invariant over time. Adjust-

ments must be made for the estimation of a according to the time hence to which the estimates refer.¹ If we take our tabulated results for Managers to relate to those who commenced as Managers in the first age-group and continued in that occupation throughout the earning span, the constants after adjustment for a $1\frac{1}{2}$ per cent growth rate will be those given in the second column of the table below.

<i>Managers</i> <i>Age Group</i>	<i>Constants</i>	
	<i>Pre-Correction</i>	<i>Post-Correction</i>
18—24	21.75	21.75
25—34	—111.72	—129.60
35—44	—142.26	—192.05
45—54	—208.14	—324.70
55—64	—64.78	—117.25

To allow for the dependence of income and asset coefficients upon age in the Modigliani hypothesis we have fitted equations such as

$$S = a + bAY + cAL. \quad (2.60)$$

If consumption and income depend on g and possibly k also, the use of age as a straight multiple can be justified only at a first approximation. To derive an equation by least-squares which describes the cross-section saving experience of a group passing right through the earning span, we adjust the data for S , Y and L to allow for, say, $1\frac{1}{2}$ per cent growth per year. These alterations to the data affect all the coefficients. Recalculations have been made for two cases: Managers under 65, and Manual, Clerical & Sales and Managers combined under age 65.

The estimates are as follows :—

Managers (under 65 years of age)

$S = -137.15$	$+ .00408 AY$	$-.00033 AL$		$R^2 = .20050$
	(.00066)	(.00039)		
$S = -119.45$	$+ .00436 AY$	$-.00038 AL$	$-.2727 AJ$	$R^2 = .20374$
	(.00074)	(.00040)	(.4351)	
$S' = -69.85$	$+ .00508 AY$	$-.00062 AL$		$R^2 = .27259$
	(.00065)	(.00039)		
$S' = -15.68$	$+ .00589 AY$	$-.00076 AL$	$-.8182 AJ$	$R^2 = .29268$
	(.00072)	(.00039)	(.4251)	

All (under 65 years of age) except Retired and Unoccupied and Self-employed

$S = -32.94$	$+ .00169 AY$	$-.00041 AL$		$R^2 = .04583$
	(.00022)	(.00014)		
$S = -17.95$	$+ .00227 AY$	$-.00054 AL$	$-.2666 AJ$	$R^2 = .05969$
	(.00025)	(.00013)	(.0667)	
$S' = -27.90$	$+ .00266 AY$	$-.00010 AL$		$R^2 = .14489$
	(.00020)	(.00013)		
$S' = -5.69$	$+ .00353 AY$	$-.00030 AL$	$-.3968 AJ$	$R^2 = .17802$
	(.00023)	(.00012)	(.0602)	

These estimates are somewhat crude. We have ignored variations in family size and employed age as a multiplier. They are merely intended to indicate the direction in which the answer to such a question is to be sought. Moreover the argument rests on the assumption that the rate of interest is zero, and discounting is ignored.

¹ Dating takes effect from the year of the survey.

CONCLUSIONS

The reader, emerging from a forest of tables, may be tempted to ask which hypothesis comes off best. If he insists on a short reply, the answer must be the Friedman hypothesis since the two main aspects of that theory—the influence of income variability and of uncertainty working through the asset/income ratio—receive conditional support from the available evidence. But such a summary judgment would be rash and unfair. For the Modigliani hypothesis, as far as the effects of income instability are concerned, the implications are essentially similar. It is, of course, true that this hypothesis does not explicitly allow for uncertainty.¹ In fact, we might suggest that our analysis indicates that the Modigliani formulation might be improved by such an amendment. The Modigliani theory stresses, in addition to income instability, the influence of age and, through our modifications to that theory, family size. It is the latter aspects of the hypothesis for which support is very much more conditional. We have noted instances where the hypothesis is apparently contradicted, but in virtually all cases seemingly incongruous results may be accounted for in one of two ways; (a) by allowing for the effects on permanent consumption of a deviation of the actual from the ‘desired’ asset/income ratio, and (b) by relaxing the assumption that the elasticity of income expectations within an occupation group remains invariant across age groups.² The former is, we feel, a useful addition to the Modigliani theory. The latter is not a fundamental criticism of the theory. It merely calls for a modification in the equation relating Y^e , a variable for which no direct measure is available, to current income. Theoretical expectations as to the influence of family size upon savings, then, receive limited support but, as with the effect of age, the impact of this variable would seem to be swamped by other influences.

There is limited empirical support for the theoretical argument that the marginal propensity to save will increase with age up to retirement. Apart from uncertainty there are several good reasons why we should not too quickly dismiss the role of age in this theory. Firstly, the theory has been employed in its most rigid form with the retention of assumption VI and a very specific approximation formula for Y^e . Secondly, we have assumed that retirement takes place at age 65, whereas for many women (and they are often the heads of planning units) and for Government employees, retirement takes effect as early as the age of 55. To the extent that some have retired during the year or are now undertaking post-retirement jobs this may go some way to account for the decline in the value of the income coefficients in the 55–64 age groups. Thirdly, it may be argued that age and family composition should be treated together, thereby allowing for differences in age, sex and other characteristics of the family membership. One’s mind runs immediately to the possibility of introducing some sort of equivalent adults’ scale

¹ But see Modigliani and Brumberg, *op. cit.*, p. 428.

² We are not, however, completely satisfied with this as an explanation for Managers at least.

but balks at the thought of having to introduce a third dimension—time. The assumption that changes in family size do not affect earnings should also be relaxed. But the complexity of these procedures is, in this writer's opinion, a point against them. In a first reconsideration it might be better to modify assumption VI to allow for a lower level of consumption after retirement, to modify the equation in Y^c , and to assume that the increased marginal consumption from unit additions to the family decreases with every such addition. But the number of plausible assumptions are legion!

This failure of the Modigliani theory to elicit strong support for those aspects that concern age and family size does not, we feel, destroy the theory. It means that the outer fortifications are impaired but not necessarily the citadel itself. No argument has been advanced that countermands assumption IV. There are, however, some grounds for thinking that a planning horizon shorter than the lifespan may be, empirically, the more appropriate.

Nevertheless a fresh attack on the problem of detecting the influence of age and family size is desirable. The empirical procedure which, *a priori*, makes the strongest appeal is to divide up a sufficiently large sample by joint age and family composition groupings. But this raises in a possibly more acute form a problem underlying our present approach. If from a one-period cross-section we wish to draw inferences concerning the behaviour of a family over the lifespan of its head we must be able to identify, within fairly narrow limits, groups which have, or are expected to have, an essentially similar family composition over the lifespan. At present, information on past and prospective family composition is not requested in our surveys. One may even doubt whether there is much likelihood of useful information being obtained from such enquiry. If we are forced to rely on existing material the margins of error in analysis across these demographic groups will remain fairly wide.

There can be little doubt that these two hypotheses have materially assisted in the sorting out and weighing up of evidence. They have facilitated the interpretation of the results of the comprehensive equations of Part I and directed attention to the shortcomings of such a method of approach.

More satisfactory and exacting tests should prove possible with a finer sub-classification of material from much larger surveys and particularly from those that provide reliable information on incomes past and prospective, and not merely current. It is at this point that the re-interview surveys conducted at Oxford may be most informative.

There would seem to be stringent empirical limits to the degree to which information on savings, income and assets more in conformity with theoretical definitions can be expected. Some attempts—not altogether satisfactory—at a more comprehensive coverage of assets have already been made. There appears to be little hope of extracting any useful information upon asset depreciation from respondents. The only hope of improvement in this aspect would seem to lie in an assessment by trained economist interviewers. But the gain in definition might be more than offset by the

decreased reliability of the observations. More immediate improvements might be effected by adding to savings and incomes superannuation and social insurance contributions by employers, and by taking explicit account of windfalls, excluded by definition from our empirical concepts of income and savings.

Our tests of the Friedman hypothesis are open-ended. We argue that if P_Y is low the permanent consumption/income ratio will be low and the marginal propensity to save high. Why in fact P_Y is low in certain age and occupation classes is a matter for outside determination from an analysis of income distributions. Full tests require this wider frame of reference. A great merit of Friedman's hypothesis is that it serves to throw light on the interconnexions between these two fields of research.

Reconciliation of the observations with the hypotheses has proved particularly difficult in three cases. Firstly, the variation in the cross-section average propensity to save (S') of Manual Workers over time does not accord with our variant of the Modigliani-hypothesis though the problem may be resolved by introducing some of the modifications listed earlier in this conclusion. Secondly, the positive coefficients of liquid assets in the S' equations for age and occupation classes appear to conflict with the theory. This remains true even when using equation (2.18) we allow for variations in family size. We have attributed these to bias in the coefficients through failure to hold permanent income constant. But, if so, the bias is appreciable. Another explanation is that the durable consumption content of S' is dominating the savings component. But these problems of definition do not seem to deter the propounders from testing their theories against survey material. We do not feel that either of our explanations is entirely satisfactory. Thirdly, while the Managerial group seem to support the income variability hypothesis, we are unable to provide adequate *a priori* reasons why this should be so.¹

No theory of savings can be adequately tested from a one-period cross-section survey alone. No theory of savings can survive without revision if it does not prove capable of explaining the observations from a one-period survey. In our analysis, support for the hypotheses has required conformity of sign and within limits magnitudes of coefficients—the economic criteria rather than purely statistical tests. The really central implications of the Modigliani and Brumberg and Friedman theories do seem to survive these tests.

* * * *

This project would not have been possible without the support of others. Cross-products were estimated by the Social Survey Division of the Central Office of Information under the guidance of Mr. J. E. Fothergill, and the estimation of the equations was most efficiently performed by Miss Jean Morris and other members of the Institute of Statistics computing staff. As an early stage of the investigation, the writer benefitted from discussions

¹ It may be that the ubiquitous expense allowances contribute towards an explanation.

with Professor Milton Friedman of Chicago and the late Dr. R. E. Brumberg of Cambridge, and has been assisted materially by being able to view an advance mimeographed copy of the former's forthcoming publication on the Consumption Function. Mr. R. F. F. Dawson assisted in the preparation of the experimental tabulations and Dr. L. R. Klein, Mr. T. P. Hill and Mr. G. D. N. Worswick have tendered helpful advice on the manuscript. To all these, to Dr. F. A. Burchardt, the Director of the Institute who entrusted the project to me, and to Mr. H. F. Lydall, who was primarily responsible for the execution of the surveys, the writer wishes to express his acknowledgement and gratitude.

Cambridge

APPENDIX A

Means of Variables (£) in Age and Occupation Groups

<i>Occupation</i>	<i>Age</i>	<i>Savings</i>	<i>Savings plus Durables</i>	<i>Net Income</i>	<i>Liquid Assets</i>	<i>Number in Income Unit</i>
Manual	1	3.32	12.97	275.95	14.24	1.275
	2	-3.22	31.83	431.71	79.32	3.026
	3	4.59	24.12	466.44	83.67	3.736
	4	-0.81	16.69	429.25	154.01	2.875
	5	9.88	13.32	348.77	125.92	2.023
	6	-34.78	-22.25	351.17	296.29	1.812
		0.19	19.05	405.91	105.59	2.768
Retired and Unoccupied	1	-2.23	2.57	148.69	89.66	1.000
	2	-8.93	16.74	238.12	77.32	2.647
	3	-0.36	1.43	262.68	77.01	3.076
	4	-45.27	-36.60	265.37	222.88	2.175
	5	-21.14	-16.56	174.46	268.17	1.270
	6	-13.64	-11.33	150.73	211.06	1.352
		-16.04	-12.28	167.13	210.69	1.467
Managers	1	-10.11	23.03	273.48	94.04	1.056
	2	-10.09	112.00	600.66	351.36	2.260
	3	42.23	122.16	833.71	325.29	3.414
	4	47.99	109.05	836.35	823.44	2.275
	5	34.44	71.30	688.15	768.07	1.837
	6	-218.21	49.50	798.91	988.81	2.099
		19.26	104.07	746.85	542.50	2.525
Clerical and Sales	1	1.45	6.02	191.15	31.95	1.210
	2	-6.57	23.48	424.14	85.64	2.321
	3	-21.48	12.26	444.74	137.25	2.905
	4	9.61	32.13	481.69	214.24	2.339
	5	4.35	11.41	399.65	287.24	2.014
	6	13.54	21.87	309.48	356.77	1.667
		-2.88	16.97	369.24	126.25	2.081
Self-employed	1	10.00	10.00	90.00	670.00	1.000
	2	110.80	143.15	559.89	228.37	3.246
	3	140.97	173.62	658.71	291.40	3.047
	4	5.72	60.61	554.49	756.68	2.912
	5	212.11	231.84	704.74	266.67	2.088
	6	68.60	98.71	526.91	496.46	1.904
		95.50	132.51	597.12	427.30	2.823
All Occupations	1	2.13	10.36	241.00	26.33	1.235
	2	0.17	40.86	442.72	109.13	2.813
	3	14.35	42.35	509.42	129.43	3.536
	4	2.92	27.52	476.54	278.70	2.686
	5	7.17	13.71	334.78	224.41	1.803
	6	-17.07	-8.69	199.79	243.49	1.445
		1.25	22.16	378.24	175.68	2.363
Grand Total						

APPENDIX A (cont.)

I MANUAL

Regression coefficients for savings functions

S = Dependent Variable					S' = Dependent Variable				
Constant	Y	L	J	R ²	Constant	Y	L	J	R ²
Age group									
18-24									
— 8.17	.042 (.023)			.033	—14.80	.101 (.027)			.128
— 5.82	.036 (.024)	— .043 (.052)		.031	—14.75	.100 (.027)	.002 (.060)		.128
— 9.35	.036 (.026)		2.08 (4.44)	.035	—16.96	.091 (.030)		3.82 (5.12)	.134
—10.34	.042 (.026)	— .044 (.052)	2.19 (4.43)	.042	—16.93	.091 (.030)	.001 (.060)	3.81 (5.12)	.134
25-34									
24.69	— .065 (.049)			.010	—24.15	.130 (.037)			.066
23.58	— .054 (.049)	— .046 (.005)		.024	—22.38	.112 (.036)	.074 (.002)		.128
19.01	— .081 (.051)		4.14 (4.35)	.015	—13.69	.159 (.038)		—7.63 (3.24)	.096
20.21	— .064 (.052)	— .042 (.031)	2.53 (4.47)	.026	—15.56	.134 (.038)	.065 (.023)	—5.13 (3.26)	.141
35-44									
— 0.61	.011 (.033)			.001	—10.04	.073 (.023)			.052
3.96	.012 (.033)	— .060 (.021)		.027	—10.79	.073 (.023)	.010 (.047)		.053
4.80	.026 (.036)		—3.25 (3.28)	.006	— 1.78	.095 (.025)		—4.96 (2.22)	.076
13.18	.035 (.036)	— .069 (.021)	—5.11 (3.29)	.039	— 1.90	.095 (.024)	.001 (.015)	—4.93 (2.27)	.076
45-54									
— 0.26	— .001 (.045)			.000	—11.71	.066 (.040)			.016
— 7.97	.038 (.044)	— .061 (.014)		.100	—11.43	.065 (.041)	.002 (.016)		.016
— 3.95	— .022 (.051)		4.44 (5.08)	.005	—10.52	.073 (.043)		—1.44 (4.50)	.017
— 8.35	.036 (.050)	— .060 (.014)	0.50 (4.93)	.100	—10.41	.072 (.047)	.001 (.013)	—1.35 (4.58)	.017
55-64									
61.69	— .149 (.045)			.100	—17.51	.088 (.037)			.057
59.82	— .131 (.046)	— .035 (.017)		.131	—16.94	.083 (.038)	.011 (.088)		.062
83.10	— .075 (.051)		—23.29 (8.35)	.168	— 4.95	.132 (.042)		—13.66 (6.85)	.095
83.37	— .044 (.051)	— .043 (.016)	—26.09 (8.22)	.215	— 4.99	.127 (.043)	.006 (.014)	—13.24 (6.93)	.097
65 and over									
19.38	— .154 (.174)			.021	30.05	— .149 (.137)			.031
35.45	— .121 (.166)	— .093 (.045)		.122	41.31	— .126 (.132)	— .066 (.036)		.110
32.29	— .123 (.205)		—13.17 (45.21)	.023	37.48	— .131 (.161)		—7.59 (35.52)	.032
53.79	— .077 (.195)	— .095 (.046)	—18.52 (42.85)	.126	52.55	— .099 (.155)	— .066 (.036)	—11.34 (34.06)	.113
Total									
10.83	— .026 (.019)			.003	—13.09	.079 (.015)			.036
10.81	— .010 (.018)	— .062 (.009)		.060	—13.10	.086 (.015)	— .025 (.007)		.050
10.20	— .033 (.022)		1.20 (2.11)	.003	—11.32	.098 (.017)		—3.40 (1.67)	.041
11.49	— .002 (.022)	— .064 (.009)	—1.32 (2.08)	.061	—10.75	.112 (.018)	— .028 (.007)	—4.52 (1.69)	.059

Standard errors are given in brackets below the coefficients.

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APPENDIX A (cont.)

II CLERICAL AND SALES

Regression coefficients for savings functions

Constant	$S = \text{Dependent Variable}$			R^2	Constant	$S' = \text{Dependent Variable}$			R^2
	Y	L	J			Y	L	J	
Age Group 18-24									
9.51	-.042 (.039)			.018	- 2.93	.047 (.034)			.030
9.36	-.036 (.041)	-.035 (.032)		.030	- 2.84	.043 (.036)	.021 (.046)		.036
11.70	-.041 (.039)		-2.05 (3.81)	.024	- 0.61	.048 (.034)		-2.18 (3.30)	.038
10.96	-.035 (.047)	-.031 (.036)	-1.48 (4.49)	.033	0.04	.044 (.047)	.027 (.036)	-2.68 (4.49)	.048
25-34									
-43.34	.087 (.027)			.016	-61.03	.199 (.071)			.125
-47.24	.136 (.091)	-.201 (.117)		.062	-61.86	.210 (.071)	-.043 (.091)		.128
- 51.90	.056 (.103)		9.25 (14.01)	.023	-53.94	.224 (.079)		-7.66 (10.70)	.133
-63.29	.118 (.093)	-.192 (.117)	5.08 (13.72)	.064	-53.90	.243 (.072)	-.058 (.091)	-8.91 (10.18)	.139
35-44									
-51.39	.067 (.067)			.016	-57.92	.158 (.061)			.100
-49.06	.169 (.071)	-.347 (.088)		.241	-58.33	.140 (.073)	.060 (.091)		.107
-41.58	.078 (.070)		-5.10 (12.93)	.021	-42.30	.176 (.064)		-8.11 (11.75)	.111
-13.59	.224 (.076)	-.397 (.089)	-18.24 (11.83)	.288	-33.89	.161 (.081)	.041 (.094)	-6.75 (12.58)	.114
45-54									
-29.94	.082 (.053)			.067	-27.64	.124 (.053)			.140
-33.06	.077 (.052)	.025 (.031)		.084	-37.15	.110 (.048)	.077 (.028)		.284
1.26	.113 (.053)		-19.73 (13.56)	.117	9.70	.161 (.054)		-23.61 (13.42)	.206
8.29	.108 (.054)	.023 (.030)	-19.11 (13.51)	.131	9.57	.144 (.050)	.074 (.027)	-21.59 (12.32)	.339
55-64									
0.19	.010 (.107)			.000	-12.33	.059 (.108)			.012
0.08	.012 (.109)	-.002 (.034)		.000	-11.86	.052 (.110)	.009 (.034)		.014
20.50	.105 (.116)		-28.92 (20.73)	.090	7.61	.153 (.118)		-28.38 (21.00)	.095
20.51	.119 (.198)	-.012 (.032)	-29.81 (20.84)	.093	7.61	.153 (.201)	-.000 (.032)	-28.40 (21.15)	.095
65 and over									
30.31	-.054 (.174)			.021	5.59	.053 (.224)			.012
28.27	-.016 (.192)	-.028 (.038)		.097	7.94	.008 (.250)	.032 (.050)		.073
42.74	-.020 (.194)		-13.87 (38.06)	.052	14.58	.078 (.253)		-10.02 (49.62)	.022
69.50	.164 (.228)	-.069 (.035)	-49.38 (11.87)	.320	- 1.49	-.033 (.341)	.041 (.053)	11.31 (17.72)	.080
Total									
-17.31	+.039 (.030)			.007	-28.37	.123 (.026)			.092
-17.40	+.053 (.031)	-.040 (.024)		.017	-28.31	.113 (.027)	.028 (.020)		.098
-12.73	+.054 (.034)		-4.94 (5.63)	.011	-19.15	.154 (.029)		-9.93 (4.78)	.111
-11.98	+.072 (.036)	-.043 (.024)	-5.83 (5.64)	.022	-19.54	.144 (.031)	.023 (.020)	-9.45 (4.81)	.115

Standard errors are given in brackets below the coefficients.

APPENDIX A (cont.)

III MANAGERS

Regression coefficients for savings functions

S = Dependent Variable					S' = Dependent Variable				
Constant	Y	L	J	R ²	Constant	Y	L	J	R ²
Age group									
18-24									
21.75	-.116 (.277)			.017	- 15.94	.142 (.143)			.151
38.37	.017 (.299)	-.565 (.178)		.439	- 19.00	.118 (.143)	.104 (.085)		.237
76.19	-.077 (.421)		-61.78 (152.58)	.030	17.54	.167 (.158)		-37.98 (57.43)	.180
13.91	.002 (.326)	-.576 (.174)	28.13 (114.53)	.442	31.25	.149 (.150)	.127 (.080)	-57.79 (32.54)	.299
25-34									
-111.72	.169 (.096)			.093	49.87	.103 (.082)			.033
-110.06	.191 (.097)	-.042 (.048)		.094	48.57	.086 (.083)	.033 (.041)		.060
-176.82	.013 (.096)		70.36 (25.50)	.254	17.48	.026 (.089)		35.01 (23.71)	.099
-178.89	.032 (.093)	-.056 (.042)	74.98 (24.89)	.307	18.49	.016 (.089)	.027 (.040)	32.76 (23.78)	.116
35-44									
-142.26	.221 (.049)			.182	-263.13	.462 (.047)			.514
-144.41	.234 (.067)	-.025 (.050)		.185	-263.10	.462 (.047)	.000 (.035)		.514
-139.45	.223 (.058)		-1.25 (24.67)	.182	-186.85	.509 (.055)		-33.73 (23.02)	.538
-139.16	.237 (.064)	-.026 (.051)	-2.35 (24.70)	.185	-186.75	.514 (.060)	-.009 (.047)	-34.14 (23.09)	.538
45-54									
-208.14	.306 (.061)			.305	-166.81	.330 (.049)			.445
-206.09	.312 (.071)	-.008 (.036)		.307	-160.12	.349 (.056)	-.027 (.028)		.462
-143.91	.349 (.066)		-44.04 (28.84)	.343	- 94.36	.378 (.051)		-49.68 (22.32)	.506
-138.73	.360 (.071)	-.013 (.035)	-45.36 (29.18)	.346	- 81.46	.405 (.054)	-.033 (.027)	-52.97 (22.08)	.530
55-64									
- 64.78	.144 (.045)			.357	- 88.84	.233 (.102)			.221
- 55.90	.097 (.044)	.031 (.017)		.444	- 84.81	.211 (.108)	.014 (.200)		.225
- 56.26	.154 (.047)		-8.28 (13.27)	.363	- 69.69	.255 (.107)		-18.60 (29.99)	.228
- 56.56	.095 (.048)	.031 (.018)	0.70 (13.00)	.444	- 69.78	.237 (.116)	.009 (.045)	-15.95 (31.39)	.230
65 and over									
274.36	-.617 (.438)			.315	-177.20	.284 (.073)			.778
264.53	-.685 (.550)	.065 (.210)		.319	-187.73	.357 (.079)	-.070 (.030)		.835
-709.28	-.791 (.378)		535.10 (184.63)	.568	-164.34	.286 (.079)		-7.00 (38.75)	.778
-791.55	-.662 (.427)	-.140 (.163)	591.36 (183.09)	.585	-210.27	.358 (.077)	-.078 (.030)	24.41 (33.24)	.841
Total									
-138.44	.211 (.035)			.152	-123.11	.304 (.029)			.349
-138.35	.225 (.038)	-.019 (.022)		.157	-123.02	.316 (.031)	-.016 (.019)		.354
-141.70	.208 (.037)		2.27 (14.33)	.152	- 96.93	.331 (.031)		-18.30 (11.82)	.361
-138.07	.225 (.044)	-.019 (.023)	-0.20 (14.60)	.157	- 92.62	.351 (.036)	-.022 (.019)	-21.22 (12.00)	.369

Standard errors are given in brackets below the coefficients.

APPENDIX A (cont.)

IV SELF-EMPLOYED

Regression coefficients for savings functions

<i>S</i> = Dependent Variable					<i>S'</i> = Dependent Variable				
Constant	<i>Y</i>	<i>L</i>	<i>J</i>	<i>R</i> ²	Constant	<i>Y</i>	<i>L</i>	<i>J</i>	<i>R</i> ²
Age group									
18-24									
25-34									
-289.00	.714 (.134)			.698	-276.53	.750 (.117)			.761
-266.90	.711 (.129)	-.076 (.047)		.717	-265.13	.748 (.115)	-.046 (.042)		.776
-427.01	.667 (.124)		50.58 (29.28)	.742	-371.46	.717 (.112)		34.79 (26.42)	.790
-399.40	.670 (.122)	-.054 (.136)	45.45 (28.80)	.751	-356.16	.719 (.112)	-.030 (.124)	31.95 (26.29)	.793
35-44									
-13.14	.234 (.051)			.271	-28.26	.306 (.050)			.390
-12.96	.235 (.050)	-.002 (.028)		.271	-26.65	.311 (.050)	-.016 (.028)		.393
3.58	.244 (.058)		-7.68 (29.32)	.273	85.35	.375 (.054)		-52.20 (27.68)	.457
3.58	.244 (.056)	-.002 (.029)	-7.64 (29.50)	.273	85.38	.378 (.053)	-.011 (.027)	-51.73 (27.82)	.458
45-54									
-125.23	.236 (.100)			.097	-90.00	.272 (.080)			.181
-112.15	.234 (.099)	-.016 (.059)		.100	-87.15	.271 (.080)	-.003 (.063)		.181
-486.01	.144 (.059)		141.50 (23.74)	.675	0.43	.295 (.076)		-35.47 (30.80)	.232
-489.46	.144 (.059)	.004 (.035)	141.69 (23.49)	.675	8.53	.294 (.076)	-.008 (.045)	-35.93 (30.45)	.233
55-64									
-213.47	.604 (.130)			.612	-233.72	.661 (.126)			.670
-213.14	.605 (.131)	-.003 (.088)		.612	-232.66	.663 (.126)	-.011 (.085)		.670
-7.44	.617 (.123)		-102.89 (62.70)	.654	-66.00	.671 (.121)		-83.76 (61.60)	.695
9.98	.607 (.123)	.043 (.087)	-113.64 (65.48)	.658	-55.55	.665 (.121)	.026 (.085)	-90.21 (64.55)	.696
65 and over									
-135.13	.387 (.065)			.651	-286.43	.457 (.063)			.731
-127.89	.402 (.065)	-.031 (.032)		.667	-133.46	.475 (.055)	-.037 (.027)		.750
-62.89	.392 (.061)		-39.41 (25.13)	.686	-63.51	.463 (.059)		-42.93 (24.29)	.765
-67.50	.400 (.063)	-.018 (.032)	-34.35 (26.47)	.692	-69.92	.474 (.061)	-.024 (.031)	-36.32 (25.40)	.772
Total									
-119.12	.359 (.043)			.332	-115.55	.415 (.039)			.450
-106.13	.365 (.043)	-.038 (.025)		.345	-104.86	.420 (.039)	-.031 (.022)		.459
-201.92	.326 (.047)		36.47 (17.65)	.365	-51.05	.442 (.041)		-28.40 (16.01)	.470
-188.67	.331 (.043)	-.037 (.024)	36.27 (17.47)	.378	-39.82	.446 (.039)	-.032 (.022)	-28.58 (15.86)	.479

Standard errors are given in brackets below the coefficients.

APPENDIX A (cont.)

V RETIRED AND UNOCCUPIED

Regression coefficients for savings functions

S = Dependent Variable					S' = Dependent Variable				
Constant	Y	L	J	R ²	Constant	Y	L	J	R ²
Age group									
18—24									
—16.09	.093 (.021)			.490	— 9.20	.097 (.046)			.016
—16.18	.096 (.022)	— .004 (.004)		.505	—11.77	.094 (.042)	.005 (.007)		.236
—	—	—	—	—	—	—	—	—	—
25—34									
—46.46	.157 (.136)			.105	—58.30	.315 (.127)			.350
—46.69	.199 (.122)	— .126 (.116)		.166	—58.78	.404 (.100)	— .269 (.090)		.581
—34.83	.152 (.138)		— 3.87 (16.35)	.116	—58.57	.315 (.130)		.09 (15.40)	.350
—23.66	.200 (.126)	— .161 (.115)	— 7.69 (11.45)	.206	—37.64	.405 (.097)	— .301 (.088)	— 7.06 (8.81)	.609
35—44									
11.15	— .044 (.025)			.142	.39	.004 (.012)			.006
11.15	— .044 (.025)	— .000 (.005)		.142	.45	.004 (.012)	— .001 (.002)		.007
8.06	— .058 (.024)		2.60 (3.08)	.197	— 1.64	— .003 (.012)		1.26 (1.49)	.061
6.43	— .059 (.024)	.002 (.005)	2.80 (4.04)	.198	— 1.73	— .003 (.012)	.000 (.002)	1.29 (1.95)	.067
45—54									
65.99	— .419 (.137)			.213	21.51	— .219 (.113)			.098
47.08	— .267 (.152)	— .096 (.033)		.354	— 2.77	— .024 (.104)	— .124 (.023)		.488
— 1.37	— .582 (.126)		50.78 (17.42)	.348	—17.61	— .313 (.099)		29.43 (13.73)	.318
— .12	— .425 (.517)	— .075 (.032)	38.75 (13.10)	.425	—68.04	— .066 (.373)	— .118 (.023)	10.39 (9.45)	.497
55—64									
41.91	— .361 (.065)			.256	20.01	— .210 (.059)			.121
39.35	— .307 (.069)	— .026 (.017)		.285	18.16	— .171 (.064)	— .018 (.016)		.142
24.44	— .413 (.096)		20.79 (32.96)	.266	14.17	— .227 (.089)		6.94 (30.35)	.129
29.41	— .335 (.079)	— .023 (.013)	9.11 (23.75)	.287	20.85	— .163 (.073)	— .019 (.012)	— 2.69 (22.03)	.142
65 and over									
— 9.23	— .029 (.027)			.003	—13.59	.015 (.027)			.001
— 3.76	— .015 (.029)	— .028 (.007)		.060	—14.16	.053 (.030)	— .025 (.007)		.044
— 6.82	— .021 (.027)		— 2.65 (6.55)	.004	— 9.92	— .027 (.027)		— 4.04 (6.54)	.003
— 4.89	— .023 (.030)	— .028 (.007)	— 2.95 (6.36)	.061	—10.25	.066 (.031)	— .025 (.007)	— 4.31 (6.40)	.046
Total									
9.72	— .154 (.025)			.066	— 2.00	— .062 (.023)			.013
8.91	— .105 (.027)	— .035 (.007)		.127	— 2.75	— .015 (.025)	— .033 (.006)		.079
— 2.59	— .183 (.026)		8.11 (4.51)	.074	— 5.70	— .076 (.024)		4.22 (4.16)	.016
4.97	— .122 (.029)	— .034 (.007)	4.52 (4.45)	.129	— 3.42	— .018 (.027)	— .033 (.006)	.76 (4.10)	.079

Standard errors are given in brackets below the coefficients.

APPENDIX A (cont.)
 VI ALL OCCUPATIONAL GROUPS
 Regression coefficients for savings functions

Age group	S = Dependent Variable				R ²		S' = Dependent Variable				R ²
	Constant	Y	L	J			Constant	Y	L	J	
18-24											
— 2.04	.017 (.022)				.004		—10.93	.088 (.019)			.117
— 1.68	.021 (.021)	— .045 (.016)			.024		—11.05	.087 (.019)	.015 (.014)		.117
— 4.14	.012 (.022)			2.66 (3.24)	.008		—11.18	.088 (.020)		0.32 (2.86)	.117
— 8.09	.017 (.022)	— .039 (.013)		5.71 (4.07)	.032		—11.77	.088 (.020)	— .006 (.013)	0.77 (3.62)	.117
25-34											
—68.07	.154 (.039)				.049		—56.59	.278 (.032)			.220
—70.98	.177 (.017)	— .064 (.022)			.079		—74.23	.267 (.014)	.030 (.018)		.227
—79.92	.139 (.038)			6.42 (4.98)	.049		—69.56	.294 (.031)		—6.97 (3.98)	.229
—78.43	.165 (.040)	— .061 (.023)		4.25 (4.96)	.081		—64.67	.283 (.033)	.025 (.018)	—6.09 (4.02)	.234
35-44											
—60.85	.148 (.018)				.113		—93.78	.267 (.016)			.333
—61.69	.154 (.016)	— .018 (.014)			.115		—92.74	.260 (.015)	.022 (.012)		.336
—41.92	.160 (.016)			—7.14 (3.88)	.123		—57.52	.291 (.014)		—13.67 (3.48)	.364
—40.48	.171 (.020)	— .027 (.014)		—8.14 (3.92)	.127		—57.99	.287 (.018)	.009 (.012)	—13.34 (3.53)	.365
45-54											
—72.89	.159 (.024)				.103		—78.31	.222 (.020)			.243
—76.92	.188 (.025)	— .035 (.012)			.128		—81.70	.247 (.021)	— .030 (.100)		.275
—81.46	.154 (.027)			4.06 (5.76)	.105		—52.93	.237 (.022)		—12.03 (4.75)	.261
—79.60	.186 (.026)	— .035 (.012)		1.30 (5.77)	.128		—51.04	.269 (.021)	— .035 (.010)	—14.85 (4.72)	.290
55-64											
—20.45	.082 (.027)				.034		—48.37	.185 (.026)			.166
—22.20	.111 (.014)	— .034 (.012)			.066		—49.34	.201 (.013)	— .019 (.011)		.176
—15.59	.143 (.029)			—31.30 (8.72)	.092		—17.67	.237 (.027)		—26.66 (8.25)	.208
+22.09	.198 (.032)	— .048 (.012)		—39.07 (8.66)	.152		—13.59	.272 (.030)	— .030 (.012)	—31.54 (8.35)	.231
65 and over											
— 7.22	.049 (.028)				.008		—30.39	.109 (.022)			.061
— 4.69	.008 (.030)	— .044 (.011)			.055		—28.46	.140 (.024)	— .034 (.009)		.101
2.75	.033 (.030)			—9.12 (0.99)	.011		— 4.43	.150 (.024)		—23.75 (0.78)	.088
4.34	.006 (.032)	— .044 (.011)		—8.27 (9.69)	.058		— 9.92	.180 (.025)	— .033 (.008)	—23.11 (7.63)	.127
Total											
—37.32	.102 (.010)				.055		—54.16	.202 (.008)			.238
—37.02	.118 (.010)	— .036 (.006)			.077		—54.02	.210 (.009)	— .018 (.005)		.243
—33.01	.112 (.011)			—3.41 (2.04)	.057		—39.64	.235 (.009)		—11.51 (1.72)	.260
—29.54	.137 (.011)	— .040 (.006)		—5.91 (2.04)	.082		—37.42	.251 (.010)	— .025 (.005)	—13.11 (1.73)	.271

Standard errors are given in brackets below the coefficients.

APPENDIX A (cont.)

VII ALL OCCUPATIONS EXCEPT SELF-EMPLOYED

Regression coefficients for savings functions

<i>S = Dependent Variable</i>					<i>S' = Dependent Variable</i>				
Constant	Y	L	J	R ²	Constant	Y	L	J	R ²
Age group									
18-24									
—2.09	.017			.004	—11.05	.089			.109
(5.21)	(.022)				(4.39)	(.019)			
—4.19	.013		2.66	.008	—11.31	.088		0.33	.118
(5.86)	(.022)		(3.40)		(5.17)	(.020)		(3.00)	
—4.40	.016	—0.51	3.22	.032	—11.25	.087	.015	0.16	.120
(5.79)	(.022)	(.016)	(3.36)		(5.17)	(.020)	(.015)	(3.00)	
25-34									
—18.73	.032			.027	—40.88	.176			.114
(16.83)	(.038)				(13.34)	(.030)			
—30.51	.014		6.99	.012	—29.59	.193		—6.68	.128
(19.03)	(.039)		(4.46)		(15.05)	(.031)		(3.50)	
—31.11	.037	—0.046	5.34	.027	—29.01	.166	.048	—4.95	.151
					(18.89)	(.040)	(.023)	(4.50)	
35-44									
—43.97	.099			0.56	—84.47	.236			.291
(5.98)	(.012)				(5.44)	(.011)			
—33.14	.107		—4.22	.061	—58.93	.256		—9.97	.318
(5.32)	(.017)		(3.03)		(4.73)	(.015)		(2.69)	
—30.29	.131	—0.056	—6.43	.079	—59.94	.247	.020	—9.18	.320
(5.09)	(.020)	(.018)	(1.56)		(4.57)	(.018)	(.016)	(1.40)	
45-54									
—69.12	.152			.108	—76.42	.216			.251
(11.02)	(.023)				(9.28)	(.020)			
—59.80	.158		—4.48	.110	—54.48	.229		—10.54	.270
(14.61)	(.024)		(5.48)		(12.18)	(.020)		(4.57)	
—59.35	.199	—0.041	—8.02	.145	—54.03	.271	—0.044	—14.17	.313
(16.03)	(.026)	(.013)	(5.49)		(13.23)	(.022)	(.010)	(4.53)	
55-64									
5.38	—0.11			.007	—25.35	.103			.068
(8.39)	(.026)				(8.51)	(.025)			
25.56	.031		—18.84	.032	—8.62	.138		—15.63	.092
(12.25)	(.029)		(7.59)		(11.75)	(.028)		(7.28)	
29.76	.079	—0.035	—25.47	.077	—6.51	.161	—0.017	—18.95	.103
(12.03)	(.032)	(.010)	(10.73)		(11.74)	(.031)	(.010)	(10.47)	
65 and over									
12.78	—0.168			.085	—14.90	.018			.002
(5.89)	(.031)				(3.93)	(.021)			
2.22	—0.189		10.23	.089	—4.68	.038		—9.90	.007
(12.27)	(.036)		(9.98)		(9.71)	(.028)		(7.89)	
4.51	—0.147	—0.039	9.52	.128	—2.99	.069	—0.029	—10.42	.044
(12.02)	(.038)	(.011)	(10.10)		(9.53)	(.030)	(.008)	(8.01)	
Total									
—23.40	.056			.018	—42.44	.163			.185
(3.57)	(.010)				(3.02)	(.008)			
—20.84	.063		—2.19	.020	—32.31	.190		—8.70	.204
(4.37)	(.011)		(1.89)		(3.66)	(.009)		(1.58)	
—17.78	.090	—0.040	—4.89	.049	—30.52	.206	—0.023	—10.28	.215
(4.33)	(.012)	(.006)	(1.91)		(3.66)	.010	(.005)	(1.62)	

Standard errors are given in brackets below the coefficients.

VIII ALL OCCUPATIONS EXCEPT RETIRED AND UNOCCUPIED

Regression coefficients for savings functions

<i>S</i> = Dependent Variable					<i>S'</i> = Dependent Variable				
Constant	<i>Y</i>	<i>L</i>	<i>J</i>	<i>R</i> ²	Constant	<i>Y</i>	<i>L</i>	<i>J</i>	<i>R</i> ²
Age group									
18—24									
— 1.29	.015 (.023)			.003	—10.94	.088 (.020)			.112
— 3.44	.010 (.023)		2.71 (3.48)	.007	—11.19	.088 (.021)		0.32 (3.06)	.112
— 4.19	.016 (.023)	— .086 (.026)	3.74 (3.41)	.046	—10.99	.086 (.021)	.024 (.023)	0.03 (3.06)	.116
25—34									
—71.43	.160 (.041)			.054	—86.74	.285 (.033)			.221
—83.03	.143 (.042)		6.74 (5.13)	.061	—73.88	.304 (.033)		—7.48 (4.10)	.231
—82.31	.171 (.044)	— .061 (.023)	4.51 (5.13)	.082	—74.18	.292 (.035)	.025 (.018)	—6.55 (4.14)	.236
35—44									
—63.64	.152 (.018)			.115	—97.14	.272 (.017)			.334
—44.42	.164 (.019)		—7.21 (3.97)	.125	—60.30	.296 (.017)		—13.81 (3.56)	.366
—43.07	.176 (.020)	— .029 (.015)	—8.25 (4.01)	.130	—60.72	.292 (.018)	.009 (.013)	—13.48 (3.61)	.366
45—54									
—77.66	.171 (.024)			.121	—80.53	.230 (.020)			.262
—84.20	.168 (.024)		2.98 (5.89)	.122	—51.11	.244 (.020)		—13.39 (4.86)	.283
—83.19	.194 (.026)	— .028 (.013)	0.85 (5.92)	.138	—50.14	.269 (.022)	— .027 (.010)	—15.43 (4.87)	.301
55—64									
—30.29	.122 (.031)			.071	—72.49	.247 (.030)			.257
25.81	.177 (.030)		—38.75 (8.98)	.179	—31.53	.287 (.030)		—28.29 (8.80)	.307
24.58	.215 (.034)	— .034 (.015)	—42.13 (9.01)	.201	—32.11	.305 (.034)	— .016 (.015)	—29.86 (8.93)	.311
65 and over									
—14.25	— .042 (.086)			.003	—86.21	.219 (.060)			.147
25.91	— .018 (.087)		—27.22 (35.35)	.012	—14.07	.262 (.060)		—48.90 (24.13)	.196
—29.24	.050 (.090)	— .087 (.039)	—26.23 (34.13)	.081	—12.18	.301 (.062)	— .049 (.027)	—48.34 (23.56)	.235
Total									
—48.59	.125 (.012)			.066	—69.34	.231 (.010)			.255
—43.22	.133 (.012)		—3.47 (2.31)	.068	—51.01	.260 (.010)		—11.87 (1.92)	.279
—43.37	.161 (.013)	— .040 (.007)	—5.59 (2.29)	.087	—51.08	.274 (.011)	— .020 (.006)	—12.92 (1.92)	.284

Standard errors are given in brackets below the coefficients.

APPENDIX A (cont.)

IX MANUAL, MANAGERS, CLERICAL AND SALES

Regression coefficients for savings functions

S = Dependent Variable					S' = Dependent Variable				
Constant	Y	L	J	R ²	Constant	Y	L	J	R ²
Age group									
18-24									
— 1.35	.015 (.023)			.003	—11.01	.089 (.020)			.113
— 3.49	.010 (.024)		2.70 (3.48)	.007	—11.27	.088 (.021)		0.32 (3.06)	.113
— 4.69	.018 (.024)	— .099 (.029)	3.89 (3.39)	.057	—10.97	.086 (.021)	.025 (.026)	0.02 (3.06)	.116
25-34									
—18.05	.030 (.041)			.002	—42.40	.179 (.039)			.112
—30.19	.010 (.041)		7.62 (4.62)	.013	—31.25	.197 (.039)		—6.99 (4.35)	.125
—31.25	.032 (.043)	— .045 (.024)	5.94 (4.67)	.028	—30.10	.172 (.040)	.049 (.022)	—5.15 (4.37)	.150
35-44									
—46.70	.103 (.020)			.059	—88.36	.242 (.017)			.297
—35.68	.112 (.017)		—4.27 (3.32)	.063	—62.42	.262 (.015)		—10.05 (2.83)	.321
—33.01	.139 (.024)	— .064 (.020)	—6.69 (3.70)	.084	—63.33	.252 (.020)	.022 (.017)	—9.22 (3.18)	.323
45-54									
—73.86	.165 (.023)			.132	—78.80	.224 (.020)			.280
—60.34	.172 (.024)		—6.23 (5.52)	.137	—52.96	.237 (.020)		—11.90 (4.63)	.300
—60.96	.206 (.026)	— .033 (.009)	—8.97 (5.57)	.160	—53.56	.270 (.022)	— .032 (.008)	—14.54 (4.64)	.326
55-64									
11.47	— .001 (.027)			.000	—36.98	.143 (.028)			.132
48.85	.047 (.028)		—27.87 (7.00)	.105	—11.61	.175 (.029)		—18.91 (7.29)	.173
48.67	.050 (.028)	— .002 (.003)	—28.15 (7.03)	.106	—11.47	.172 (.029)	.002 (.003)	—18.66 (7.32)	.173
65 and over									
84.99	— .341 (.111)			.155	—30.36	.046 (.079)			.007
56.56	— .370 (.125)		21.71 (43.35)	.160	7.11	.085 (.089)		—28.62 (30.81)	.025
69.87	— .270 (.133)	— .089 (.045)	10.87 (42.07)	.224	14.61	.141 (.096)	— .050 (.033)	—34.73 (30.36)	.072
Total									
—28.36	.069 (.012)			.023	—53.16	.185 (.010)			.200
—24.37	.077 (.013)		—2.81 (2.13)	.025	—39.85	.211 (.011)		—9.37 (1.75)	.221
—25.60	.107 (.014)	— .039 (.008)	—5.06 (2.16)	.045	—40.33	.223 (.012)	— .015 (.006)	—10.23 (1.79)	.224

Standard errors are given in brackets below the coefficients.

APPENDIX B

Extreme Observations

Ninety-eight sets of observations were excluded from the effective sample in computing the estimates in this paper. Of these, 58 were excluded because no information on liquid assets at the beginning of the year was available.

The remaining 40 were distributed by age and net income as follows:-

<i>Age Group</i>	<i>Frequency</i>	<i>Net Income Group (£)</i>	<i>Frequency</i>
18—24	2	Under 100	14
25—34	2	101— 500	7
35—44	5	501—1000	6
45—54	9	1001—1500	—
55—64	4	1501—2000	1
65 and over	18	2001 and over	12
	—		—
	40		40

We list the recorded observations for S, Y, L, J and A below.

<i>S</i>	<i>L</i>	<i>Y</i>	<i>J</i>	<i>A</i>
1639	202	4127	6	47
1800	205	2008	3	68
2048	9357	2754	2	68
—1168	94	917	3	36
—1288	778	1953	4	45
—1490	5370	709	3	55
252	472	2	2	67
—	2	—	1	48
208	542	10	1	23
227	550	18	4	39
195	1527	2973	2	55
632	1803	2997	6	32
9	1510	3145	3	44
65	360	3668	2	51
1020	—	3816	1	42
415	2000	3821	1	59
25	690	537	2	62
350	713	453	1	41
33	9218	914	4	48
331	9952	403	2	82
1800	10205	2008	3	68
562	12714	2287	1	49
242	12775	989	2	77
56	3523	472	2	73
350	5800	452	1	46
410	4275	985	1	68
1154	5133	2183	2	63
60	460	68	2	80
—	—	82	4	94
200	1075	35	4	67
73	1356	44	1	74
—	—	68	3	92
100	1100	40	2	88
842	830	40	2	47
93	1450	93	4	66
84	3627	148	4	54
400	2500	77	4	68
50	2100	50	2	68
4	—	164	4	34
—	192	189	4	24

APPENDIX C

1953 Savings Survey¹

Number of observations utilised in this study—2,003

Number of observations in each cell (by age and occupation groupings)

Age Group	Manual	Clerical & Sales	Managers	Self- employed	Retired	Total
18—24	126	73	9	1	13	222
25—34	207	72	49	20	14	362
35—44	226	52	69	46	14	407
45—54	193	45	64	40	29	371
55—64	109	32	32	14	73	260
65 and over ...	44	6	7	18	306	381
Total	905	280	230	139	449	2,003

Weights of Strata

Rateable value £30 and over 1.0
Rateable value under £30 5.4

Definitions of occupation groups. See H. F. Lydall, *National Survey of Personal Incomes and Savings* (appendix) BULLETIN, Nov.—Dec., 1952.

APPENDIX D

The definitions of variables used in this empirical study

S—Savings of income-unit² in £s:—

- (1) Payments for life assurance and superannuation by income unit.
- (2) Net purchases of real property.
- (3) Net purchases of securities.
- (4) Net loans to individuals.
- (5) Net decrease in indebtedness covering both repayment of mortgage principal and consumer debt.
- (6) Net increase in liquid assets except for currency holdings.
- (7) Business saving.
- (8) Deduction of gifts and other lump sums received.

S'—Savings plus durable goods expenditures of income unit in £s.

As for S, plus expenditures on durable goods exceeding £25 in value.

Y—Net disposable income of income unit in £s = Gross disposable income less income tax, surtax and national insurance contributions.

Gross disposable income includes all cash income of the income unit before tax, net annual value of owner-occupied property and, in the case of farmers, an estimate of the value of produce consumed on the farm. Gross income includes income from war disability pensions, national insurance benefits, co-operative society dividends, and private allowances received from relations or friends. In the case of the Self-Employed, business expenses

¹ For an analysis see T. P. Hill, L. R. Klein and K. H. Straw—'The Savings Survey 1953—Response Rates and Reliability of Data'; T. P. Hill, 'Incomes, Savings and Net Worth,' BULLETIN, Vol. 17, February 1955, and May 1955.

² See L. R. Klein, *Patterns of Savings*, BULLETIN, May 1955, pp. 173–7.

allowable for tax purposes are deducted from income. Income in the form of rents from property was assessed after deducting normal repair allowances. Income received from boarders where these did not exceed three per house was neglected, in other cases income recipients were treated as boarding-house keepers. Two-thirds of the income received by those who let rooms, without food, to lodgers was treated as profit. Pensions received from previous employment and also old age, widows and disability pensions were classed as income.

Notes

(1) Capital gains and losses, realised or unrealised are excluded from survey definitions of Savings and Income.

(2) No deduction of depreciation on physical assets is made from savings totals.

(3) Interest earned on Life Assurance and pension funds is not apportioned to individuals nor are contributions by employers to such schemes treated as saving.

(4) Strictly, the addition to saving through assurance or pension funds consists of the increase in the full reserve value of the policy or agreement. Assessment difficulties force us to use premiums or contributions paid by employees as their net addition to this form of saving.

(5) The net receipts from the sale of durable goods during the year are treated as dissaving, whenever sales exceed purchases.¹

J—Number in 'family'—strictly the income unit as defined in the Survey.

The income unit is defined as follows :

(1) All single persons of 18 years of age or more, whether living alone or with other members of their family are regarded as separate income units. If they have dependent children of their own under 18 years of age, these children form part of the income unit.

(2) Married couples living together are assumed to pool their incomes and each couple is counted as a single income unit. Children under 18 are included in the income unit.

The following special case should be noted: when a single person 18 years of age or more has an income of his own not exceeding £50 per year and is living with relations, this person is assumed to form part of their income unit.

A—Age of head of income unit in years.

L—Liquid assets holdings of income unit (in £s) one year prior to date of interview. This is calculated from information requested on liquid asset holdings at time of interview and the change in these holdings over the year.

¹ See H. F. Lydall, *National Survey of Personal Incomes and Savings*, BULLETIN, Oct. and Nov., 1953, pp. 346-7.

The Survey definitions of Savings and Income differ in a number of respects from those implicit in the Modigliani and Friedman theories.

Their definition of savings would appear to be broadly equivalent to :

(1) Our definition of Savings plus durables goods expenditure (S')

Plus :—

(2) Superannuation contributions by employers.

(3) Social Insurance contributions by the individual and the State destined for individuals on retirement.

(4) Additions to currency holdings.

(5) Capital gains during the year, gifts and other capital transfers.

Minus :—

(5) Depreciation at replacement cost of houses and other durable assets.

(6) Capital losses during the year, donations and other capital transfers.

The corresponding definitions of (measured) income relevant to the Friedman hypothesis would be broadly equivalent to :

(1) Our definition of net income.

Plus :—

(2) Net income from durable assets (other than that from houses which is already approximated in the Survey).

(3) Contributions to Assurance and Pension funds by employers and appropriate portions of earnings on these funds.

(4) That portion of taxation which is destined to provide a claim on the State for Retirement and similar pensions.

Minus :—

(4) Benefits received from Assurance and Pension funds and from State Security Schemes.

Capital gains net of losses are added into net worth and adjustments must also be made to income on this account.

THE NATION'S INTELLECTUAL INVESTMENT

By P. J. D. WILES

I. INTRODUCTORY

Economists and politicians are increasingly coming to recognise the importance of education for productivity. The burthen of this article is that if skill and knowledge are capital they should be valued like other capital. It is astonishing that no estimates exist for the annual gross expenditure on education. But, further, capital depreciates, and so I attempt also a net expenditure on education; *i.e.* after deducting the replacement cost of the education of those who die or retire.

The main results are :

gross current educational expenditure as a percentage of G.N.P. in 1953 :
2.7 per cent;
net current educational expenditure as a percentage of net national income in 1953 (all depreciation being at replacement cost) : 1.25 per cent;
no estimates are presented for the capital stock involved.

For those unfamiliar with educational statistics the following must be said. There are three statistics-compiling bodies : the Ministries of Education in England and Wales and in Northern Ireland, and the Department of Education at the Scottish Office. The 1953 report of the first Ministry is hereinafter simply called ' Report ' ; that of the Department is called ' Scottish Report ' . The Northern Irish Ministry's report is referred to as such. The English and Welsh Ministry omits a great number of independent schools which it does not recognize as efficient. These are mainly the smaller preparatory and convent schools; they are a sore trouble to the statistician. The other two authorities include virtually all regular education.

Local authorities finance most of the education in all three countries, but are helped by central grants. The Ministries and Department call these schools ' maintained and assisted ' or ' under control of education authorities ' . Other schools, mainly secondary, receive central grants but are not under the control of local authorities; these are called ' direct grant ' , or words to that effect. The two categories together are ' grant-aided ' . The rest are ' independent ' or ' other ' .

Capital expenditure on education is, of course, already included in the investment totals of the national income statisticians. We are here concerned with current expenditure only. The former may be compared with the construction of machine tools, the latter with that of looms. Both are investment, but the former is more ' roundabout ' .

Finally it should be borne in mind that these calculations are crude, hasty and approximate. They do not profess to show more than orders of magnitude, as they represent the research of only one worker over a short period.

2. We have, first, a direct figure for expenditure by L.E.A.s out of the rates and out of Central Government (including the Northern Ireland

Government) grants, on 'education': £341 million.¹ This leaves about £16mn. in direct grants from the Ministries and Department of Education to the direct grant (in Scotland, grant-aided voluntary secondary) schools.² This must be left out of account as it is too small a part of these schools' total expenditure, which must be otherwise estimated.

3. What proportion of the £341mn. went on primary and secondary local authority schools? An analysis of English and Welsh L.E.A. expenditure (Education Committee's Year Book 1944-55) gives the following items that must be excluded (year ending March 1953):

	£'000
Further education... ..	19,507
Aid to pupils	14,466
Teacher training	4,872
Medical inspection and treatment ...	6,916
Capital expenditure from revenue ...	4,481
School meals	26,373
Total	76,600

This leaves in nurseries, inspection, teachers' superannuation, etc., besides such obvious items as loan charges, teachers' salaries and school maintenance: £241.3mn. out of £317.9mn. Applying this proportion to the U.K.'s £341mn. we get £266.5mn. spent on primary and secondary education in local authority schools.

4. We now require, for use in further calculations, the cost of each type of schooling. Of the £241.3mn. left for England and Wales in Sec. 3 the L.E.A.s spent on:

	(£mn.)
Nursery and primary schools ...	£110.1 (4,436,140)
Secondary schools	78.9 (1,769,848)
Special schools	5.2 (45,262)
	£194.2

The figures in brackets give the numbers of pupils. Allocating the overheads of inspection, teachers' superannuation, etc., in the same proportions, we obtain the following expenditure on teaching per child:

Nursery and primary	£30.8
Secondary	£55.2
Special	£143.8

This may be roughly checked from the Scottish expenditures, which are unfortunately not split up into kinds of school. As in England and Wales,

¹ National Income and Expenditure Blue Book, 1946-53, p. 55.

² Ibid. pp. 55-6: 374-341-17=16.

76 per cent of education authority expenditure is directly educational, as opposed to maintenance, teacher training etc. It amounts to £35.4 mn.¹, making an average of £43.2 as opposed to £38.6 in England and Wales.

The numbers of pupils covered by this Scottish expenditure are :

Nursery	4,323
Primary	581,400
Secondary	237,219
Special	10,338
‘ Receiving education from education authorities elsewhere than at school ’	
	1,687
	834,967

5. We now turn to the education that is privately financed or partly so. We possess the following definite figures only (pupils on the registers, various dates in 1953) :

	Under 11	Over 11
England and Wales, direct grant	21,566	77,608
England and Wales, other schools recognized as efficient	96,192	147,980
Northern Ireland, voluntary primary ²	73,387	24,390
Northern Ireland, voluntary secondary ³	—	26,100
Scotland, grant-aided Schools not under the management of education authorities	3,200 ¹	11,533 ⁴
Scotland, independent schools	9,412	11,677

6. Only the English and Welsh statistics omit any schools, the ‘ independent schools not recognised as efficient.’ These are estimated at about 3,500 in number ; they have about 200,000 pupils and 14,000 staff. These figures are the estimates of the Ministry of Education⁵ ; they coincide closely with two more indirect calculations of my own, which are quite independent of each other. We shall not take up space here by reproducing them.

By one of these indirect calculations the proportion of pupils under 11 is 70 per cent, by the other 45 per cent. When we contemplate the extreme variability of this percentage for the various educational systems in Sec. 4 and 5, it is very difficult to assign any *a priori* probability to either percentage. Strike an average, then, and call it 57 per cent. We arrive at 114,000 under 11 and 86,000 over 11.

7. The final category of school is the approved school. There were

¹ *Scottish Report*, p. 72.

² Collating pp. 29 and 32 of the Northern Irish Ministry's Report for 1953-4, Cmd. 338.

³ Collating pp. 41 and 42 of Cmd. 338, and assuming that voluntary schools are of the same size as county schools.

⁴ Not given in the Scottish Report, where these are merged with education authority schools. The total, 14,753, is from the Annual Abstract. I have split the ages in the proportion of the English and Welsh direct grant.

⁵ Private letter.

population of about 25,000 in residence. The published cost of teacher training unfortunately includes maintenance, but as explained in Sec. 14 we wish to include maintenance as a separate item from the age of 15 onwards. In the year ending March, 1953, English and Welsh L.E.A.s spent £4,872,000 on teacher training, and the Ministry almost £3mn. ; in all £310 per head. Put rather £110 per head for education alone (i.e. assume £200 for maintenance, as in Sec. 16 ; this is not unreasonable as the Ministry inform me that the cost of secondary education for children over 15 is already about £90).

By parity of reasoning we obtain 700 students in Northern Irish teacher training establishments. There were also 3,434 in Scottish ones, the Scottish Report being as so often more informative. This gives a total of 29,100 students, and an educational expenditure of £3.2 mn.

10. University expenditure (which includes all teaching hospitals) was as follows in October 1952–September 1953 (£mn.):¹

Great Britain, excluding Oxford and Cambridge colleges ...	28.7
Less capital expenditure met from income ...	—0.3
Less fellowships, scholarships, prizes etc. (other than those from independently administered funds, not included in the first place)	—0.3
Northern Ireland (in view of the smallness of the sum, the above two adjustments have not been made) ...	0.5
Less overlap with Sec. 9 (See Sec. 11) ...	—0.5
Oxford Colleges (excluding chapel services, choirs, choir schools, college entertainments, catering account deficits, scholarships, exhibitions, studentships, external expenditure, University contributions) ...	1.5
Cambridge Colleges (as for Oxford, so far as the extreme complication of the accounts permits) ...	1.5
	31.1

In Great Britain 81,500 students attended universities full time, 16,000 part time ; in Northern Ireland 2,300 and 500. In Great Britain the average length of a full time course was about 3.4 years.²

Some university expenditure is on research, not education. I make no attempt to exclude this. It is inextricable from other expenditures, and much of it is of course highly educational, especially in that it is teachers' training for prospective dons.

11. The university departments of education must not be counted twice. They provide about one quarter of the trained teachers in England and Wales, but³ their students are all graduate and do only one year. I infer,

¹ *University Grants Committee Report for 1953*, Cmd. 9130, p. 37 ; *Annual Abstract ; Oxford University Gazette*, 28 Jan., 1955 ; *Cambridge University Recorder*, March, 1953.

² Table 3 of Cmd. 9130 : take an advanced course as 1.5 years, a first degree course as 3.3 years, and a first diploma as 2.0 years ; assume that all advanced students first took a degree, making 4.8 years, and use the numbers in each category as weights.

³ Min. of Ed., *Training and Supply of Teachers*, 1951, p. 24.

arbitrarily, that they spent 15 per cent of the money in U.K. Hence the deduction of £0.5 mn. in Sec. 10.

12. Statistics record the following numbers of students taking *further education* in 1953 (Annual Abstract) :

England and Wales, L.E.A. or direct grant	2,062,000
University extra-mural or voluntary organizations	137,000
Scotland	532,000
Northern Ireland, technical	30,000
Northern Ireland, joint committee on advanced education	3,000
	2,764,000

These courses will vary from expensive technical studies two nights a week throughout the year, to ten week seminars on current affairs of which almost the only cost is the lecturer's fee of 30s. a time. The former greatly predominate. Thus, much the majority of all further education in the U.K. is provided by the grant-aided establishments of English and Welsh local authorities. These spent £19.5 mn. on 2,054,000 students, who averaged just under 100 hours a year.¹ This is £9.49 per head. Taking £9.40 for the U.K. as a whole we get an educational expenditure of £26.0 mn.

13. We have now to consider apprenticeship schemes, management training, training within industry, borstals, vocational and disabled training, industrial rehabilitation, private tutorial and commercial colleges, correspondence courses and private tuition. It is impossible, and would be tedious, to be exact. Say one half the figure for recorded further education as reckoned in the previous section, or £13 mn.

14. Finally we have to consider the opportunity cost of keeping pupils of 15 and over away from production ; for part of the cost of educating an adolescent is the money he would otherwise have earned. Their numbers are as follows :

England and Wales, all grant-aided	248,457
England and Wales, independent recognized as efficient ...	54,100
England and Wales, independent not recognized as efficient ²	31,400
Scotland, all schools	31,490
Northern Ireland, all schools ³	10,810
Universities, full time less teacher trainees ⁴	78,100
Teacher trainees, all	28,300

All estimates of the productivity in an alternative occupation of these 'idle mouths' are arbitrary, for the release of so many *ex hypothesi* uneducated adolescents on to the labour market would change it very much, even

¹ *Report*, p. 117 ; *Education Committees Yearbook*, 1954-5, p. 574.

² Taking the same proportion of 15 plus to 11 plus as for independent recognized as efficient, England and Wales.

³ *Cmd.* 338, p. 42.

⁴ 83,800 less 25 per cent of 28,300, as in Sec. 11.

in the long run. It is perhaps better to reckon them at a fair maintenance charge: £200 over 18 and £100 below. The total annual maintenance then comes to £58.8 mn.

15. We may now add up :

	£mn.	Section
All local authority schools, U.K.	267	3
Direct grant, private etc. schools, U.K.	53	8
Teacher training	3	9
Universities, other than teacher training	31	10
Further education, recorded	26	12
Miscellaneous	13	13
Maintenance of students, 15 plus	59	14
	452	

In 1953 the G.N.P. at market prices was £16,811 mn. Of this educational expenditure was, then, 2.69 per cent. Other gross investment was £2,759 mn. Educational expenditure was 16.4 per cent of this. If we add it to ordinary investment, we obtain true gross investment ; this was £3,211 mn., of which education was 14.1 per cent.

16. We now turn to net educational expenditure, i.e. we seek to deduct from the gross figure the value at replacement cost (not of course historical cost nor yet market price, for there is no market price) of the formal education received by those dying or retiring.

Now net investment in material goods is an extremely tricky concept and it may be objected that net investment in education is even more nebulous. This does not appear to be so. Thus, an equally long education for all would be much less productive than a system of unequal courses according to ability, costing the same amount. But the same could be said of different investment patterns for coal or agriculture ; stupidity can always bring about an excess of cost over productivity. Again progress renders certain types of education obsolete, and obsolescence brings about a very sharp distinction between valuations, according to cost and according to market. But obsolescence is actually more serious for material goods : a middle-aged chemist can learn to use radio-active trace elements, but a steam locomotive cannot learn to go by electricity. Thirdly, the proliferation of new types of education gives rise to awkward valuation problems : is £10,000 spent on training only doctors yesterday equal to £10,000 spent on training doctors and physiotherapists to-day ? Some price index compiled on the chain principle is clearly required—but again the problem is more severe for material goods, among which new types arise still more often. Finally, net investment is related in no clear way to technical progress, and therefore in no clear way to the growth of productivity. Technical progress—and so also growth—is quite compatible with dis-investment, and certainly the mere re-investment of 'depreciation

allowances' in better training may lead to growth. But the same again applies with equal force to new machinery.

This is not the place to go very deeply into these questions: it is enough to show that our concept of net educational investment is as valid or as invalid as all other net investment concepts. We proceed below very much as do those who estimate the depreciation of material capital: reckoning on the whole at cost, suitably written up for the fall in the value of money, and troubling less about obsolescence and quality change. Nevertheless, it is of interest to compare the quality of the educational experience withdrawn by death and retirement to that brought into the labour force by its juvenile accessions. The latter might be higher because (a) the young entrants had been educated for longer, (b) they were more naturally intelligent, (c) they had received more effective teaching, or (d) they had memorised more correct, more advanced or more useful data than those previously taught.

Now (a) is both statistically measurable and a matter of cost only; it involves no obsolescence or quality change. Alterations in (a) therefore enter directly into our estimate of depreciation. The balance of the evidence as to (b) is—if an outsider may summarise—that the average of natural intelligence is declining, but not hitherto at all considerably.¹ As the matter is highly controversial, and for our period insignificant, I shall omit it. As to (c), I doubt whether teaching to-day is more effective than it was when those now retiring were educated. We all know that there is no discipline left, and that the 3 Rs, indeed everything demanding mental effort, are now neglected for such progressive subjects as citizenship and how to brush your teeth. But it cannot be believed that this outweighs the improved training of teachers, the much increased use of visual aids, the development of special schools etc., etc. It is, however, rather staggering to learn that pupil/teacher ratios in elementary schools have not changed since 1913-14! On balance I think we may leave out (c), except that possibly secondary teaching is more effective now.² As to (d), there is no question at all: obviously there is a continual improvement in the scientific data memorised (which is most to our point), and it is not simply naïf to assert a certain gradual improvement in other subjects. We shall, therefore, be safely underestimating the superiority of the economic qualifications of school-leavers over those dying or retiring in 1953 if we consider (a) alone. This indicates that our depreciation figure will be an overestimate.

But the balance of school-leaving, death and retirement is not the only factor when we try to estimate the depreciation of our intellectual capital. Education never stops. During a man's whole life he forgets much and learns more. But after school, night-school or university, this process has no identifiable cost, so in costing the net or gross accumulation of intellectual

¹ Very recently evidence has come out that under elevens of to-day are more intelligent than those of before the war, while this does not apply to those above eleven.

² University teaching surely is not: the Edwardian bachelor don at Oxbridge found much more time for his pupils than his married, research-biassed successors at any university.

capital we have perforce to neglect this very important item. This is as much as to assume that the net experience and wisdom, annually accumulated by those in the prime of life, equals that accumulated since school which those who die or retire take away with them. No one can measure these things, so that is perhaps enough on this subject. We are left, then, for the net educational effort of the country the years of formal education annually brought with them by school leavers etc. minus the years of formal education annually taken out by those who die or retire. We may now proceed.

17. Let all men retire at 65, and all women at 60. The educational background of the present population over 20 is happily known to us from a random sample of 3,670 males and 4,520 females living in England and Wales in July 1949.¹ The sample is divided into broad age-groups which in 1953 would have been 64 plus, 54-63, 44-53 and so on. I have applied the percentages for their educational background to the age-groups 65 plus, 55-64, 45-54 etc., given for the English and Welsh population in the Annual Abstract for 1953. Note that no allowance is made for class-differential death rates; also that these percentages are not mutually exclusive: e.g. those with university education were probably also previously at grammar schools and are shown in both places.

18. The population below 20 is not covered by Mrs. Floud. Since only a very small number of them died in 1953, I shall not burden the text with my full calculations. In what follows, then, all references to the educational experience of those dying before 20 must be taken as based on workings not shown.

19. We may now sum up the years of educational experience. Beginning with education up to 11, deaths of those aged 5 to 10 numbered 1,989 at an average of 7.1 years. This makes 2.1 years' education since turning 5, or 4,177 years. Deaths of those aged 11 to 19 number 2,740, making 16,440 years of education 5 to 10. From Secs. 4, 5 and 8 above I deduce that 5 per cent of the relevant population was in 1953 being educated in independent primary schools. This fits very well with the 3.4 per cent for males and 7.5 per cent for females of Mrs. Floud's youngest age group. This makes 1,031 years in independent primary schools so far. Of all the remaining 556,400 people dying or retiring 57,571 had been in such schools; or 3,338,400 (total) and 345,430 (private) years. We thus have altogether 3,359,000 years of elementary education of which 346,461 are private.

20. Turning to 11 plus education, deaths of those aged 11 to 19 total 2,673, with 8,320 years of 11 plus education to their credit. Of these about 572 years were in independent schools. To this must be added the years experienced by the adults in Sec. 19. Now in 1919-20 the average age of those

¹ D. V. Glass et al., *Social Mobility in Britain*. I refer to Mrs. Floud's chapter, pp. 128, 134. Another approach would have been to the 1951 Census' 'Occupied Population classified by Terminal Education Ages' (1 per cent Sample, p. 216). But unfortunately this does not give types of education, and omits females not gainfully occupied. These latter of course are idle capital, which has costs like any other.

TABLE II
Percentage with undermentioned education

Men	Abso- lute number	Ind. Prim.	Gram- mar	Sec'd'y Board- ing	Teacher Train- ing	Uni- versity	Other Fur- ther
Attaining 65...	174,100	8.2	8.3	2.3	1.26 ³	1.71	15.3
Dying between :							
55 and 64 ...	46,006	6.2	12.1	1.8	0.72 ³	2.00	19.3
45 and 54 ...	23,523	5.4	9.6	2.1	0.42 ³	1.18	24.2
35 and 44 ...	8,172	4.3	14.5	1.8	0.63 ³	2.64	32.9
25 and 34 ...	4,381	3.9	17.5	1.6	0.55 ³	2.53	34.7
20 and 24 ...	1,640	3.4 ¹	24.0 ¹	1.7 ¹	0.76 ⁴	2.13 ^{4,6}	35.0 ⁵
Totals, male	257,800	18,978	24,620	5,572	2,712	4,536	45,992
Women							
Attaining 60...	259,600	9.8	8.1	3.1	1.56	0.78	12.0
Dying between :							
55 and 44 ...	12,353 ²	9.8	8.1	3.1	1.56	0.78	12.0
45 and 54 ...	15,296	7.2	8.4	2.2	0.92	0.68	18.4
35 and 44 ...	6,877	7.6	14.9	1.5	1.36	1.04	21.9
25 and 34 ...	3,469	6.7	15.4	1.8	1.21	1.38 ⁷	26.1
20 and 24 ...	976	7.5 ¹	18.0 ¹	2.3 ¹	1.45 ⁴	0.68 ^{4,6}	26.0 ⁵
Totals, female	298,600	38,593	25,048	8,955	4,533	2,351	38,114
Total numbers dying of retiring	556,400	57,571	49,668	14,527	7,245	6,887	84,106

¹ Extrapolation, based on figure for age 24 only in original.

² Registrar General's Statistical Review for 1953, p. 113.

³ Not given in the original : I have taken 46 per cent of the female percentage throughout, as this is the average ratio of males to females undergoing teachers' training in 1913-14 and 1919-20 (*Statistics of Public Education, 1919-20*, p. 144).

⁴ Not given in the original : the ratio to the population of half the completions in 1948-49 to 1952-3. The other half is assumed to be over 24 by 1953.

⁵ Guessed. On the one hand further education continues to grow, on the other many have not by the age of 20 yet received it.

⁶ Completions are taken as 90 per cent of recorded entries into full time courses in 1946-7 to 1950-1.

⁷ As deduced from the original. By the technique of footnote 4, however, this figure looks rather too high.

leaving elementary schools for no other form of education was 13.7;¹ of these there were 465,000. The average age of those leaving a 'secondary school on the grant list' was 14.8²; of these there were 68,050. This may be compared with the more recent figures of 14.1 and 16.7 years respectively. Let us therefore apply to all deaths and retirements over 20, averages of 13.8 and 15.0.³ Then they all received 2.8 years of 11 plus education, and the 'grammar' and 'secondary boarding' columns another 1.2 years. We arrive at the following numbers of years of 11 plus schooling :

Deaths 11 to 19 :

other than private education ...	7,748
private education ...	572

Deaths 20 plus and retirements :

without grammar or boarding education ...	1,378,000
with ditto ...	256,500

¹ *Statistics of Public Education, 1919-20*, Table 26.

² *Ibid.*, Table 78.

³ These low figures are taken because the old much outweigh the young.

21. Full-time university education to-day averages 3.4 years (Sec. 10), and a successful part-time course presumably the equivalent of about 2.5 full years (somewhere between the length of a diploma and a first degree course). Put 3 years as an average, since we have to deal with the early part of this century when advanced courses were less common. There were (Sec. 19) about 556,000 deaths and retirements of those aged 21 (not 20) and above. Let the average percentage of these cases who received university education be 1.80 for males, 0.78 for females. This gives us 21,500 years of university education. This clearly includes graduate teachers' training, and evidently it is only ordinary teachers' training that is reported separately in Sec. 17, so that we have no overlap to exclude here, as in secs. 9 to 11. Now in 1913-14 and 1919-20 the average teachers' training course was 2.3 years,¹ while to-day it is 1.4 years (Sec. 9). Put 2.1 years, heavily weighting the older figure as usual, and we get a total of 15,215 years. It is difficult, finally, to know how long 'other further' education lasts. Say one year on the average, or 84,200 years (making an allowance for deaths below 20).

22. How much had been spent, at replacement cost, on these people's education? Up to 11 state education costs £30.8 p.a. (Sec. 4), and we have agreed to exclude maintenance. Including the usual double estimate for independent schools I calculate the value of education received up to 11, excluding nursery education, at £104.6 mn.

From 11 education costs £55.2 p.a. in L.E.A. schools, the same in direct grant establishments, and perhaps £110.4 p.a. in others. On the average in Prof. Glass' sample 1.9 per cent of males aged 20 plus and 2.5 per cent of females received education in boarding schools. This word means 'public' schools, as explained by Mrs. Floud,² and is therefore a much narrower category than 'other' secondary schools. It must exclude, for instance, all Roman Catholic day schools and the big London semi-'public' day schools. Our own data do not on the other hand contradict the proportions of 25.4 per cent (male) and 20.0 per cent (female) for 'grammar' and 'boarding' together for the youngest group in the sample.³ What our own data do yield is 248,000 receiving 11 plus education in all independent schools, and 583,355 in grant-aided grammar schools. Using these proportions for all the years involved the average annual cost for Mrs. Floud's 'grammar' and 'boarding' together is £72. Applying £55.2, £110.4 and £72.0 where appropriate to the data for 11 plus education we arrive at a total of £95.0 mn.

Our pupil's maintenance cost (£100) sets in at the age of 15. The proportion of 15 plus to 11 plus pupils has not changed over time for those with a secondary education, if we may judge from the direct grant schools: it was 29.9 per cent in 1913-14, 30.0 per cent in 1919-20,⁴ and 30.5 per cent

¹ *Statistics of Public Education, 1919-20*. Table 162.

² Glass, *op. cit.*, p. 103.

³ Thus at the age of 12 about 136,000 pupils out of a population of 551,000 were in grant-aided grammar schools, secondary or 'primary and secondary' schools recognized as efficient, and other independent schools. So 24.7 per cent of a random sample of 12 year olds would say they *had ever been* at a 'grammar' or 'boarding' school.

⁴ *Statistics of Public Education, 1919-20*.

in 1953. The average number of years of 15 plus education for those who received any in such schools was 0.70 in 1913-14, 0.75 in 1919-20, 0.80 in 1953. There are no figures for independent schools in the early period, but a habit of somewhat later leaving seems to be well established: thus the proportion of 15 plus to 11 plus in 1953 was 36.8 per cent. Put then an average of 0.8 years of schooling 15 plus for both the 'grammar' and the 'secondary boarding' categories of Sec. 19. This gives 51,400 such years. Add 359 for those dying under 20, and we arrive at a total of 51,800, maintenance cost £5.2 mn.

Finally, we must consider university education. Counting part-time students as one quarter, there were 87,925 students in the U.K. in 1953 (Sec. 10). Subtract the 7,100 in university education departments (Secs. 9, 11) and we get 80,825, costing £31 mn., or £394 per head per annum. Thus the 21,500 years in Sec. 21 cost £8.5 mn. At £110 a head (the guess of Sec. 9) 15,215 years of teachers' training cost £1.7 mn. 84,200 years of further education at £9.5 a head (Sec. 12) cost £0.8 mn. Let one-sixth of the university education, as in 1953, be part time. Then the maintenance of full time university students and teacher trainees at £200 p.a. cost £6.3 mn. Finally, let us throw in £10 mn. for nursery schools and various miscellaneous items.

23. We thus obtain $£104.6 + 95.0 + 5.2 + 8.5 + 1.7 + 0.8 + 6.3 + 10.0 = £229.1$ mn. This must be expanded for Scotland and Northern Ireland. As the large majority of the people we are considering were being educated at the turn of the century, this may be most simply done by applying the proportion of the population in England and Wales to that of the United Kingdom in 1901: i.e. 85 per cent. Since England and Wales is the most advanced part of the kingdom, contains almost all the private schools and has a somewhat higher school-leaving age, put arbitrarily 87 per cent., making the U.K. total £263 mn. This figure, then, is one of the many very speculative items to be deducted from the G.N.P. if we wish to obtain the national income. Net expenditure on education was thus £189 mn. at replacement cost in 1953, or approximately 1.25 per cent of the net national income.¹

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¹ Taking other depreciation at replacement cost to be £1,407mn. (Redfern, *Journal of the Royal Statistical Society*, 2/1955, p. 152), and the 'true' net national income, i.e. the ordinary net national income less educational replacement, to be £15,100mn.